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**CURRICULUM VITAE**

**of**

**ANDREAS MANDELIS PhD, FRSC, FCAE, FAPS, FSPIE, FAAAS, FASME, LEL**

**Canada Research Chair (Tier I) in Diffusion-Wave and Photoacoustic Sciences and Technologies**

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**I(a). PERSONAL INFORMATION**

**1. Date of Birth:** June 22, 1952 **Date:** November 16, 2019

**2. Rank:** Full Professor of Mechanical, Industrial,  
Electrical and Computer Engineering, and  
Biomaterials and Biomedical Engineering

**3. Education**

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<b>Degree</b>	<b>Institution</b>	<b>Department</b>	<b>Thesis Field</b>	<b>Year</b>
B.S. (Magna cum Laude)	Yale University (Fullbright Scholar)	Physics	High Energy Particle Scattering	1974
M.A.	Princeton University	Mechanical & Aerospace Engineering (M.A.E.)		1976
M.S.E.	Princeton University	M.A.E. Applied Physics	Thermal Decomposition of Electronically Metastable Materials (Solid State Science)	1977
Ph.D.	Princeton University	M.A.E. Applied Physics	Applied Physics; Photoacoustic/ Photothermal Science	1979

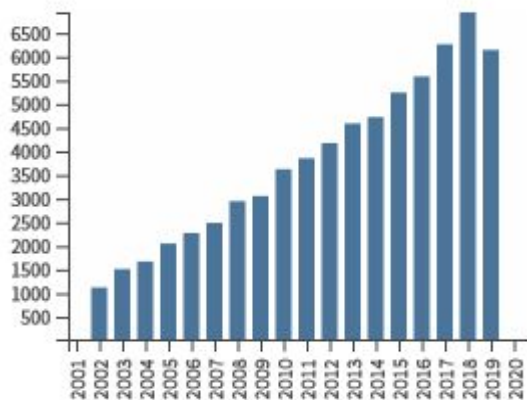
**I(b). POSITIONS HELD**

	<b>Institution</b>	<b>Department</b>	<b>Position</b>	<b>Year</b>
1	Bell Northern Research, Ottawa	Silicon Process R&D	Member Scientific Staff	1980-81
2	University of Toronto	Mechanical Engineering	Assistant Professor	1982-86
3	University of Toronto	Mechanical Engineering	Associate Professor	1986-90
4	Eidg. Technische Hochschule Lausanne, Switzerland (EPFL)	Chemistry	Invited Professor	1988-89
5	University of Toronto	Mechanical and Industrial Engineering (MIE)	Full Professor	1990 -
6	University of Toronto	Electrical and Computer Engineering	Professor (Cross-Appointment)	1990 -
7	University of Cyprus	Natural Sciences	Visiting Professor of Solid-State Physics	1995-96
8	University of Toronto	MIE	Associate Chair, Graduate Studies	2000-02
9	University of Toronto	Center for Advanced Diffusion-Wave and Photoacoustic Technologies (CADIPT)	Director	2003-present
10	Ruhr Universitaet Bochum	Physics; Festkoerperspektroskopie III	A. von Humboldt Visiting Professor Award	2003-04
11	University of Toronto	Institute of Biomaterials and Biomedical Engineering	Professor (Cross-Appointment)	2008-
12	Cyprus Institute – Cyprus Research and Educational Foundation		Professor (Status only)	2008 – 10
13	Professional Engineers Ontario		PEO Ltd Eng Licensee	2008-
14			Canada Research Chair (Tier 1)	2008-15
15	Helmholtz Zentrum München (Technical Univ. Munich)	Institut für Biologische und Medizinische Bildgebung	A. Von Humboldt Re-invited Visiting Professor Award (2 <sup>nd</sup> invitation award)	2012-13
16	University of Electronic Science and Technology of China (UESTC), Chengdu, China	School of Optoelectronic Information	1000 Talents Professor	2013 - 18
17			Canada Research Chair (Tier 1)	2015-22
18	Helmholtz Zentrum München (Technical Univ. Munich)	Institut für Biologische und Medizinische Bildgebung	A. Von Humboldt Re-invited Visiting Professor Award (3 <sup>rd</sup> invitation award)	2017-18
19	York University	Mechanical Engineering	Adjunct Professor, Graduate Program	07/01/2017 - 06/30/2021

## II(a). RESEARCH PUBLICATIONS IMPACT

Web of Science, Cited Reference Search (all databases): (Hirsch) *h index* = 96  
(*h*-index is the largest number *h* such that *h* publications have at least *h* citations).

Sum of Times Cited: 77,539 (61,199 without self citations)  
Citing Articles 53,434 (49,528 without self citations) (November 16, 2019)



Cited Reference Search citation report for A. Mandelis on 11/16/2019

## II(b). RESEARCH ACHIEVEMENT AND INVENTION HIGHLIGHTS

**Andreas Mandelis and his research team pioneered the following analytical instrumentation and measurement methodologies**

1. Photopyroelectric Spectroscopy (PPES) and Detection and the physics of the photopyroelectric effect (1983): AIP PACS number 78.20.nc was assigned to “photopyroelectric effects” in 2007.
2. Frequency-modulated (FM) time-delay photothermal detection: the first photothermal-wave radar (1986).
3. Photocarrier Radiometry (PCR) of semiconductors (2003): AIP PACS number 78.56.Cd was assigned to “photocarrier radiometry” in 2009.
4. The Thermal-Wave Resonant Cavity sensor (with Jun Shen; 1996)
5. Common Mode Rejection Demodulation (CMRD) contrast amplification technique as a platform signal generation and processing methodology of optimal contrast dynamic range for solid-state defect imaging, fluid pollutant monitoring and non-destructive evaluation of industrial materials (2000)

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6. The photothermoacoustic radar or sonar for subsurface tissue imaging (with Ying Fan and Sergey Telenkov; 2006)
7. The physics of the thermal-wave inverse problem (“thermal harmonic oscillator”, 1985) and the first photothermal inverse problem imaging technique (thermal-wave tomography, 1997).
8. First photothermal radiometric rate-window application to optoelectronic materials (1993)
9. Deep-Level Photo-Thermal Spectroscopy (DL-PTS) of defects and impurities in semiconductors (with Jun Xia; 2007): AIP PACS number 79.10.Ca was assigned to “Deep-level photothermal spectroscopy” in 2009.
10. First application of thermal-wave inverse problems to industrial steel hardness depth profiles (1991) with applications to the aerospace, automotive, thermal-barrier coating, and steel heat treating industries.
11. First hybrid (chirp modulation) photothermal detection methods for subsurface defects in solids (1986)
12. First photothermal radiometry and modulated luminescence application to early caries detection in dental enamel (2000). It led to the creation of a Toronto spin-off company (Quantum Dental Technologies, (QDT), Inc.) and the Canary<sup>TM</sup> early caries detection system.
13. First all-optical hydrogen sensor (1989).
14. Thermal-Wave Radar (TWR) and Thermal-Wave Radar Imaging (TWRI; with Nima Tabatabaei and Stephen Abrams; 2009 - 2011)
15. Thermal-Wave Coherence Tomography (Thermophotonic Chirp Scan and Binary Phase Code Imaging), (TCT; with Nima Tabatabaei; 2011)
16. Lock-in carrierography (dynamic optoelectronic photoluminescence imaging) of semiconductors (with Alexander Melnikov; 2010 – 2012).
17. Wavelength-Modulated Differential Photothermal Radiometry (WM-DPTS) for blood glucose monitoring, a noninvasive thermophotonic method with the highest sensitivity to human glucose concentrations (hypoglycemic to hyperglycemic range) to-date (with Xinxin Guo; 2009 – 12).
18. Truncated-Correlation Photothermal Coherence Tomography (TC-PCT; with Sreekumar Kaiplavil; 2013).
19. Wavelength-Modulated Differential Photoacoustic Imaging (WM-DPAI) for quantitative cancer imaging (with S.S. Choi and B. Lashkari; 2013-16).
20. Single-Frequency Thermal-Wave Radar Imaging (SF-TWRI; with Alexander Melnikov and Konesh Sivagurunathan; 2017-18).
21. Enhanced Truncated-Correlation Photothermal Coherence Tomography (with Pantea Tavakolian and Konesh Sivagurunathan; 2017)

### III (a). SCIENTIFIC AND TECHNICAL PUBLICATIONS

#### 1. Refereed Journal Publications

(In reverse chronological order and by research theme areas)

**Total Refereed Journal Publications to-date:**

**417**

#### 1. Thermophysical and Thermodynamic Property Measurements using Thermal Waves

31. X. Guo, A. Mandelis, J. Tolev, and K. Tang, "Photothermal radiometry parametric identifiability theory for reliable and unique nondestructive coating thickness and thermophysical measurements", *J. Appl. Phys.* **121**, 095101 (2017); doi: 10.1063/1.4977246.
30. Robert D. Chirico, Michael Frenkel, Joseph W. Magee, Vladimir Diky, Chris D. Muzny, Andrei F. Kazakov, Kenneth Kroenlein, Ilmutdin Abdulagatov, William E. Acree, Jr., Joan F. Brenneke, Paul L. Brown, Peter T. Cummings, Theo W. de Loos, Daniel G. Friend, Anthony R. H. Goodwin, Lee D. Hansen, William M. Haynes, Nobuyoshi Koga, Andreas Mandelis, Kenneth N. Marsh, Paul M. Mathias, Clare McCabe, John P. O'Connell, Agilio Pádua, Vicente Rives, Christoph Schick, J. P. Martin Trusler, Sergey Vyazovkin, Ron D. Weir, and Jiangtao Wu, "Improvement of Quality in Publication of Experimental Thermophysical Property Data: Challenges, Assessment Tools, Global Implementation, and Online Support", *J. Chem. Eng. Data* **58**, 2699–2716 (2013); dx.doi.org/10.1021/je400569s.
29. **(Plenary presentation review article)** A. Mandelis, "Photoacoustic, Photothermal, and Diffusion-Wave Sciences in the Twenty-First Century: Triumphs of the Past Set the Trends for the Future", *Int. J. Thermophys.* **33** (10-11), 1776–1777 (2012). DOI 10.1007/s10765-012-1336-4 Public view ppt: [http://cadift.mie.utoronto.ca/History\\_of\\_Photoacoustics-Photothermics.ppt](http://cadift.mie.utoronto.ca/History_of_Photoacoustics-Photothermics.ppt).
28. **(Invited Review Article)** A. Mandelis, "Photopyroelectric effects and pyroelectric measurements: "Invited Review Article: Photopyroelectric calorimeter for the simultaneous thermal, optical and structural characterization of samples over phase transitions" [*Rev. Sci. Instrum.* **82**, 121101 (2011)]" *Rev. Sci. Instrum.* **82**, 120901 (2011); doi:10.1063/1.3669517 (4 pages).
27. C. Wang, A. Mandelis, H. Qu and Z. Chen, "Influence of laser beam size on measurement sensitivity of thermophysical property gradients in layered structures using thermal-wave techniques", *J. Appl. Phys.* **103**, 043510 (1-8), 2008.
26. A. Matvienko and A. Mandelis, "Quantitative one-dimensional thermal-wave cavity measurements of fluid thermophysical properties through equivalence studies with three-dimensional geometries", *Rev. Sci. Instrum.* **77**, 064906 (1 – 9) (2006). *Paper selected for inclusion in Virtual Journal of Biological Physics Research* ([www.vjbio.org](http://www.vjbio.org)), **12** (1) 064906 (1 - 9), July 1, 2006.
25. A. Bendada, N. Baddour, A. Mandelis and C. Moreau, "Experimental investigation on the reliability of thermal wave interferometry in the thermophysical characterization of plasma sprayed coatings", *Int. J. Thermophys.* **26** (3), 881 – 892 (May 2005).
24. A. Matvienko and A. Mandelis, "High-precision and high-resolution measurements of thermal diffusivity and infrared emissivity of water-methanol mixtures using a pyroelectric thermal-wave resonator cavity: frequency-scan approach" *Int. J. Thermophys.* **26** (3), 837 – 854 (May 2005).

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23. J. A. Balderas-Lopez and A. Mandelis, "New Photopyroelectric Technique for Precise Measurements of the Thermal Effusivity of Transparent Liquids", *Int. J. Thermophys.* **24** (2), 463 - 471 (March 2003).
22. J. A. Balderas-Lopez and A. Mandelis, "Self-normalized photothermal technique for accurate thermal diffusivity measurements in thin metal layers", *Rev. Sci. Instrum.* **74** (12), 5219 - 5225 (December 2003).
21. J. A. Balderas-Lopez and A. Mandelis, "Self-consistent photothermal techniques: Application for measuring thermal diffusivity in vegetable oils", *Rev. Sci. Instrum.* **74** (1), 700 - 702 (January 2003).
20. J. A. Balderas-Lopez, M. Moreno-Marquez and A. Mandelis, "Self-normalized photoacoustic thermal diffusivity measurements of dental resins", *Int. J. Polymer Mater.* **51**, 639-646 (2002).
19. J. A. Balderas, A. Mandelis and J. A. Garcia, "Normalized Photoacoustic Techniques for Thermal Diffusivity Measurements of Buried Layers in Multi-Layered Systems", *J. Appl. Phys.* **92** (6), 3047 - 3055 (15 September 2002)
18. J. A. Balderas-Lopez and Andreas Mandelis, "Thermal diffusivity measurements in liquids using signal common-mode-rejection demodulation in a thermal-wave cavity", *J. Appl. Phys.* **90** (7), 3296-3300 (1 October 2001).
17. J. A. Balderas-Lopez and A. Mandelis, "Thermal Diffusivity Measurements in the Photoacoustic Open-Cell Configuration using Simple Signal Normalization Techniques", *J. Appl. Phys.* **90** (5), 2273-2279 (1 September 2001).
16. J. A. Balderas-Lopez and A. Mandelis, "Self-Normalized Photothermal Techniques for Thermal Diffusivity Measurements", *J. Appl. Phys.* **88** (11), 6815 - 6820 (1 December 2000).
15. J. A. Balderas-Lopez, A. Mandelis and J. A. Garcia, "Thermal-Wave Resonator Cavity Design and Measurements of the Thermal Diffusivity of Liquids", *Rev. Sci. Instrum.* **71** (7), 2933-2937 (July 2000).
14. J. A. Garcia, A. Mandelis, B. Farahbakhsh, C. Lebowitz and I. Harris, "Thermophysical Properties of Thermal Sprayed Coatings on Carbon Steel Substrates by Photothermal Radiometry", *Int. J. Thermophys.* **20**, Number 5, 1587-1602 (1999).
13. C. Wang and A. Mandelis, "Measurement of Thermal Diffusivity of Air using Photopyroelectric Interferometry", *Rev. Sci. Instrum.* **70**, Number 5, 2372-2378, May 1999.
12. G. Pan and A. Mandelis, "Measurements of the Thermodynamic Equation of State via the Pressure Dependence of Thermophysical Properties of Air by a Thermal-Wave Resonant Cavity", *Rev. Sci. Instrum.* **69**, Number 8, 2918-2923, August 1998.
11. J. Shen, A. Mandelis and H. Tsai, "Signal Generation Mechanisms, Intracavity-Gas Thermal-Diffusivity Temperature Dependence, and Absolute IR Emissivity Measurements in a Thermal-Wave Resonant Cavity", *Rev. Sci. Instrum.* **69**, No. 1, 197-203, January 1998.
10. A. Mandelis, M. Nestoros, A. Othonos and C. Christofides, "Thermophysical characterization of Commercial Paper by Use of Laser Infrared Radiometry", *J. Pulp Paper Sci.* **23**, J108-J112, March 3, 1997.
9. E. MacCormack, A. Mandelis, M. Munidasa, B. Farahbakhsh and S. Sang, "Measurements of the Thermal Diffusivity of Aluminum Using Frequency-scanned, Transient- and Rate-Window Photothermal Radiometry. Theory and Experiment", *Int. J. Thermophys.* **18** (1), 221-250, January 1997.
8. M. Munidasa and A. Mandelis, "Comparison Between Conventional Photothermal Frequency Scan and the Lock-in Rate Window Method in Measuring Thermal Diffusivity of Solids", *Rev. Sci. Instrum.* **65**, 2344-2350, July 1994.
7. Z. Chen and A. Mandelis, "Scanning Photothermal Rate Window Spectrometry. Methodologies and Applications to the Thermal Diffusivity Measurement of Ultrahigh Thermal Conductors: CVD Diamonds", *Phys. Rev. B* **46**, 13526 - 13539, 15 November 1992 II.



6. **(Invited Review Paper)** A. Mandelis, "Photothermal Analysis of Thermal Properties of Solids", *J. Thermal Anal.* **37**, 1065 - 1101, 1991.
5. B. Peralta, S.C. Ellis, C. Christofides and A. Mandelis, "Photopyroelectric Measurement of the Thermal Diffusivity of Recrystallized High Purity Aluminum", *J. Res. Non Destructive Eval.* **3**, 69 - 80, April, 1991.
4. S.B. Peralta, Z.H. Chen and A. Mandelis, "Simultaneous Measurement of Thermal Diffusivity, Thermal Conductivity and Specific Heat by Impulse Response Photopyroelectric Spectrometry: Application to the Superconductor  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ ", *Appl. Phys. A* **52**, 289 - 294, May, 1991.
3. S.B. Peralta, Z. Chen and A. Mandelis, "Photopyroelectric Measurement of the Thermal Diffusivity of  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$  and  $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_x$ ", *Ferroelectrics* **118**, 425 - 433, 1991.
2. I.A. Vitkin, S.B. Peralta, A. Mandelis, W. Sadowski and E. Walker, "Photopyroelectric Impulse Response Measurements of Single Crystal  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ . A Temperature Study", *Meas. Sci. Technol.* **1**, 184 - 188, February, 1990.
1. A. Mandelis, F. Care, K.K. Chan and L.C.M. Miranda, "Photopyroelectric Detection of Phase Transitions in Solids", *Appl. Phys. A* **38** (2), 117 - 122, October 1985.

## 2. Photovoltaic Solar Cell Diagnostic Techniques, Imaging and NDE

20. M. Liu, F. Che, B. Sun, O. Voznyy, A. Proppe, R. Munir, M. Wei, R. Quintero-Bermudez, L. Hu, S. Hoogland, A. Mandelis, A. Amassian, S. O. Kelley, F. P. García de Arquer, and E. H. Sargent, "Controlled Steric Hindrance Enables Efficient Ligand Exchange for Stable, Infrared-Bandgap Quantum Dot Inks", *ACS Energy Letters* **4**, 1225 - 1230 (2019) DOI: 10.1021/acsenergylett.9b00388
19. L. Hu, A. Mandelis, and Q. Sun, "Quantitative Ultrahigh-Frequency Heterodyne Lock-in Carrierography Multi-Imaging of Colloidal Quantum Dot Solar Cells", *IEEE J. Photovoltaics* **9** (1), 132 - 138 (January 2019).
18. L. Hu, M. Liu, A. Mandelis, Q. Sun, A. Melnikov, and E. H. Sargent, "Colloidal Quantum Dot Solar Cell Electrical Parameter Non-Destructive Quantitative Imaging Using High-frequency Heterodyne Lock-in Carrierography and Photocarrier Radiometry", *Solar Energy Materials Solar Cells* **174**, 405 - 411 (2018).
17. L. Hu, M. Liu, A. Mandelis, A. Melnikov, and E. H. Sargent, "Colloidal Quantum Dot Solar Cell Power Conversion Efficiency Optimization using Analysis of Current-Voltage Characteristics and Electrode Contact Imaging by Lock-in Carrierography", *Progress in Photovoltaics* **25**, 1034 - 1050 (2017) DOI: 10.1002/pip/2920
16. L. Hu, A. Mandelis, Z.Y. Yang, X. Guo, X. Lan, M. Liu, G. Walters, A. Melnikov, and E. H. Sargent, "Temperature- and Ligand-Dependent Carrier Transport Dynamics in Photovoltaic PbS Colloidal Quantum Dot Thin Films Using Diffusion-Wave Methods" *Solar Energy Materials Solar Cells* **164**, 135 - 145 (February 2017)
15. L. Hu, A. Mandelis, A. Melnikov, X. Lan, S. Hoogland and E. H. Sargent: "Study of Exciton Hopping Transport in PbS Colloidal Quantum Dot Thin Films Using Frequency- and Temperature-Scanned Photocarrier Radiometry", *Int. J. Thermophys.* **38** (7) (2017) DOI: 10.1007/s10765-016-2143
14. L. Hu, Z. Yang, A. Mandelis, A. Melnikov, X. Lan, G. Walters, S. Hoogland and E. H. Sargent, "Quantitative Analysis of Trap-State-Mediated Exciton Transport in Perovskite Shelled PbS Quantum Dot Thin films Using Photocarrier Diffusion-Wave Non-Destructive Evaluation and Imaging", *J. Phys. Chem. C* **120**, 14416 - 14427 (June 22, 2016). DOI: 10.1021/acs.jpcc.6b04468
13. L. Hu, A. Mandelis, X. Lan, A. Melnikov, S. Hoogland, and E. H. Sargent, "Imbalanced Hole Mobility and Schottky Junction Induced Anomalous Current-Voltage Characteristics of Excitonic PbS Colloidal Quantum Dot Solar Cells", *Solar Energy Materials Solar Cells* **155**, 155-165 (2016) <http://dx.doi.org/10.1016/j.solmat.2016.06.012>

12. A. Mandelis, L. Hu and J. Wang, "Quantitative Measurements of Exciton Hopping Transport Properties in Depleted-Heterojunction PbS Colloidal Quantum Dot Solar Cells from Temperature Dependent Current-Voltage Characteristics", Royal Soc. Chem. Advances **6**, 93180–93194 (2016).
11. Q. M. Sun, A. Melnikov, A. Mandelis "Quantitative Carrier Density Wave Imaging in Silicon Solar Cells Using Photocarrier Radiometry and Lock-in Carrierography", Int. J. Thermophys. **37**(45), 1-9 (April 2016) DOI: 10.1007/s10765-016-2054-0
10. Y. Zhang, A. Melnikov, A. Mandelis, B. Halliop, N. P. Kherani and R. Zhu, "Optoelectronic transport properties in amorphous/crystalline silicon solar cell heterojunctions using frequency-domain photocarrier radiometry: Multi-parameter measurement reliability and precision studies", Rev. Sci.Instrum. **86**, 033901 (8 pages) (March 2015).
9. A. Melnikov, A. Mandelis, B. Halliop, and N.P. Kherani, "UV Laser Photocarrier Radiometry of c-Silicon with Surface Thin Hydrogenated Amorphous Si Film", Int. J. Thermophys. **36** (5-6), 1037-1044 (May-June 2015) DOI: 10.1007/s10765-015-1835-1
8. J-Y. Liu, A. Melnikov, and A. Mandelis, "Non-Contact Determination of Local Efficiency of mc-Si Solar Cells Using Quantitative Lock-in Thermographic and Carrierographic (Photoluminescence) Imaging", Int. J. Thermophys. **36** (5-6), 987-996 (May-June 2015) DOI 10.1007/s10765-014-1786-y
7. J-Y Liu, A. Melnikov, and A. Mandelis, " Contactless measurement of electrical parameters and estimation of current-voltage characteristics of Si solar cells using the illumination intensity dependence of lock-in carrierography (photoluminescence) images", J. Appl. Phys. **114**, 104509 (6 pages), (September 2013)
6. J-Y. Liu, A. Melnikov, and A. Mandelis, "Silicon solar cell electrical parameter measurements through quantitative lock-in carrierographic (photoluminescence) and thermographic imaging", Phys. Stat. Sol. A **210**, No. 10, 2135 - 2145 (2013) / DOI 10.1002/pss+a.201329206
5. A. Mandelis, Y. Zhang and A. Melnikov, "Statistical theory and applications of lock-in carrierographic image pixel brightness dependence on multi-crystalline Si solar cell efficiency and photovoltage", J. Appl. Phys. **112**, 054505 (1 – 13) (2012), doi: 10.1063/1.4749413.
4. A. Melnikov, B. Halliop, A. Mandelis and N. P. Kherani, "Optoelectronic transport property measurements of an amorphous silicon passivated c-silicon wafer using non-contacting methodologies", Thin Solid Films **520** (16), 5309–5313 (1 June 2012).
3. A. Melnikov, P. Chen, Y. Zhang, and A. Mandelis, "Lock-in and heterodyne carrierographic imaging characterization of industrial multicrystalline silicon solar cells", Int. J. Thermophys. **33** (10-11) 2095-2102 DOI 10.1007/s10765-012-1292-z (November 2012).
2. A. Melnikov, A. Mandelis, J. Tolev, P. Chen and S. Huq, "Infrared lock-in carrierography (Photocarrier radiometric imaging) of Si solar cells, J. Appl. Phys. **107**, 114513 (1 – 11), 2010.
1. A. Mandelis, A. Melnikov, J. Tolev, J. Xia, S. Haq, and E. Lioudakis, "Non-destructive infrared optoelectronic lock-in carrierography of mc-Si solar cells, Quant. Infra Red Thermogr. (QIRT) J. **7** (1) 35 – 54 (2010).

### **3. Carrier-Density Diffusion-Waves in Semiconductors and Metrology using Carrier and Thermal Waves**

77. **JAP Editors' Pick:** P. Song, A. Melnikov, Q.M. Sun, A. Mandelis, and J.Y. Liu, "Uniqueness range optimization of photocarrier transport parameter measurements using combined quantitative heterodyne lock-in carrierography imaging and photocarrier radiometry", J. Appl. Phys. **125**, 065701 (9 pages), 22 January 2019. <https://doi.org/10.1063/1.5083168>
76. P. Song, A. Melnikov, Q. Sun, A. Mandelis, and J-Y. Liu, "Contactless non-destructive imaging of doping density

- and electrical resistivity of semiconductor Si wafers using lock-in carrierography”, IOP Semiconductor Science and Technology **33**, 12LT01 (6pp) (2018). <https://doi.org/10.1088/1361-6641/aae810>
75. J. Wang, A. Mandelis, B. Li, and C. Gao, “Temperature and Size Dependent Exciton Dynamics in PbS Colloidal Quantum Dot Thin Films using combined Photoluminescence Spectroscopy and Photo-Carrier Radiometry”, J. Phys. Chem. C, **122** (10), pp 5759–5766 (2018). DOI: 10.1021/acs.jpcc.7b11933.
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173. S. Telenkov and A. Mandelis, “Photoacoustic Sonar: Principles of operation, imaging and signal-to-noise analysis in time and frequency domains”, Proc. SPIE Society of Photo-Optical Instrumentation Engineering Conf. 7899 (“Photons plus Ultrasound: Imaging and Sensing 2011”), 23-25 Jan. 2011, San Francisco, CA, USA, Vol. **7899**, pp. 78990Y 1 – 9 (SPIE Press, April 2011).
174. A. Hellen, A. Mandelis, Y. Finer and B. T. Amaechi, “Quantitative Evaluation of Simulated Human Enamel Caries Kinetics using Photothermal Radiometry and Modulated Luminescence”, Proc. SPIE Society of Photo-Optical Instrumentation Engineering Conf. 7883 (“Therapeutics and Diagnostics VII” ), 23-25 Jan. 2011, San Francisco, CA, USA, Vol. **7883**, pp. 78834M1 1 – 14 (SPIE Press, February 2011).
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182. Qiming Sun, Alexander Melnikov, and Andreas Mandelis, “Quantitative Heterodyne Lock-in Carrierographic Imaging of Silicon Wafers and Solar Cells”, 2014 IEEE 40th Photovoltaic Specialist Conference (PVSC-40), pp. 1860-1864 Doi: 10.1109/PVSC.2014.6925287
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185. **(Invited)** B. Lashkari, L. Yang, L. Liu, J. W. Y. Tan and A. Mandelis, “Photoacoustic and ultrasound characterization of bone composition”, Proc. SPIE **9303**, Photonic Therapeutics and Diagnostics XI, 93033X (February 26, 2015); Vol. **9303**, pp. 93033X (1-7). doi:10.1117/12.2181093; <http://dx.doi.org/10.1117/12.2181093>.
186. E. Dovlo, B. Lashkari, S.S. Choi and A. Mandelis, “Co-registration of ultrasound and frequency-domain photoacoustic radar images and image improvement for tumor detection”, Proc. SPIE 9316, Multimodal Biomedical Imaging X, 93160J (March 5, 2015); Vol. **9316**, pp. 93160J (1-6). doi:10.1117/12.2079898; <http://dx.doi.org/10.1117/12.2079898>.
187. B. Lashkari, S. S. Choi, E. Dovlo and A. Mandelis, “Photoacoustic Cross-Correlation High-Frame-Rate and Phase Spectroscopy: Two New Biomedical Imaging Modalities”, Proc. Society of Photo-Optical Instrumentation Engineering (SPIE), Conf. Vol. **9708**, pp. 97081J (1-6) (March 15, 2016); doi: 10.1117/12.2211761
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189. E. Dovlo, B. Lashkari, S.S. Choi, and A. Mandelis, "Wavelength-Modulated Differential Photoacoustic (WM-DPA) imaging: a high dynamic range modality towards noninvasive diagnosis of cancer", Proc. Society of Photo-Optical Instrumentation Engineering (SPIE), Conf. (March 15, 2016); Vol. 9708, pp. 97081Y (7 pages)  
doi:10.1117/12.2211761
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191. SS. S. Choi, B. Lashkari, A. Mandelis, J. J. Weyers, A. Boyes, C. Yang, S. F. Foster, N. Alves-Kotez, M. Harduar and B. Courtney, "Frequency-domain differential photoacoustic radar: theory and simulation for ultra-sensitive cholesterol imaging," Proc. Society of Photo-Optical Instrumentation Engineering (SPIE), Photons Plus Ultrasound: Imaging and Sensing 2019, Vol. **10878**, pp. 1087812 (1-9) (2019).

#### **V(a). TECHNICAL POPULARIZED PUBLICATIONS**

1. A. Mandelis, "Photothermal Rate-Window Instrumentation and Measurements in Industrial Opto-Electronic Materials", Laser und Optoelektronik **26** (2), April 1994, pp. 66.
2. A. Mandelis, "Luminescence, IR Imaging find cracks in teeth", Biophotonics International, November 2000, 22-23.
3. A. Mandelis, "New Tools May Lessen Time in Dentist's Chair", Photonics Spectra, November 2000, 50-51.
4. A. Mandelis, "Photothermal Diagnostic Technologies Go Where No Light Has Gone Before", Optics and Photonics News (OPN; published by the Optical Society of America), June 2002 issue.

#### **V(b). ARTICLES IN POPULARIZED SCIENCE MAGAZINES, TV COVERAGE AND PAPERS WRITTEN ABOUT A. MANDELIS' RESEARCH**

1. "Future Tech: Dentistry by Laser Light. Laser beams make a play to replace the scalpel, the dental drill, and the X ray", feature article by Diane Martindale, Discover Magazine, Vol. **23**, No. 6, June 2002, pp. 24-25.
  2. Tyler Hamilton (Toronto Star), "Quantum Detection of Tooth Decay: A new laser device designed to detect the earliest stages of tooth decay could help dentists stop cavities in their tracks", MIT Technology Review, Friday March 23 (2007). On-line article at: <http://www.technologyreview.com/Biotech/18426/>
  3. Randy Atkins, Senior Media Relations Officer, National Academy of Engineering ([www.nae.edu](http://www.nae.edu)) The National Academies, "Tooth Decay Detector: A new technology may soon allow you to avoid x-rays at the dental office. It could spot cavities earlier too", Interview aired on WTOP radio series on Engineering, April 14 and 15, 2007, Washington D.C. 103.5 FM; [www.nae.edu/radio](http://www.nae.edu/radio)
  4. "Technology advances oral care", The Globe and Mail, Monday April 2, 2007.
  5. Tyler Hamilton, "A Quantum leap for treating tooth decay: Local dentistry start-up develops laser prototype to better detect cavities", The Toronto Star, Business Section, July 2 (2007).
  6. "New Dental Technology May Help Replace The Dreaded Drill", Monday July 14, 2008. CityTV, Toronto, [http://video.citynews.ca/index.jsp?auto\\_band=x&rf=sv&fr\\_story=176b9c3cce63cb8f27714b78225d19fa0bb874b4](http://video.citynews.ca/index.jsp?auto_band=x&rf=sv&fr_story=176b9c3cce63cb8f27714b78225d19fa0bb874b4) or: [http://www.citynews.ca/news/news\\_24743.aspx](http://www.citynews.ca/news/news_24743.aspx) (Coverage of Photothermal Radiometry and Modulated Luminescence (PTR/LUM) based "Canary dental caries detection system" developed at the CADIFT, UofT)
- "New dental practice aimed at minimizing dental procedures", Sunday July 3, 2008. CTV, Toronto,

7. <http://watch.ctv.ca/news/health/lifetime-with-monica-matys/#clip64385> (Coverage of Photothermal Radiometry and Modulated Luminescence (PTR/LUM) based “Canary dental caries detection system” developed at the CADIFT, UofT)
8. “Breakthrough Technology may Revolutionize Tooth Decay Treatment”, FDA News, Device Daily Bulletin, July 7, 2008 <http://fdanews.com/newsletter/article?issueId=11739&articleId=108258> (Coverage of Photothermal Radiometry and Modulated Luminescence (PTR/LUM) based “Canary dental caries detection system” developed at the CADIFT, UofT)
9. “New technology to affect treatment of tooth decay”, Dental Economics, July 3, 2008, [http://www.dentaleconomics.com/display\\_article/333523/54/none/none/DEPnw/New-technology-to-affect-treatment-of-tooth-decay](http://www.dentaleconomics.com/display_article/333523/54/none/none/DEPnw/New-technology-to-affect-treatment-of-tooth-decay) (Coverage of Photothermal Radiometry and Modulated Luminescence (PTR/LUM) based “Canary dental caries detection system” developed at the CADIFT, UofT)
10. “Groundbreaking dental device will prevent cavities”, Niagara Falls (ON) Review, 15/05/2009, p. H5 (Coverage of PTR/LUM dental caries technology).
11. “Quantum Dental Technologies Canary System Claims Top Perch. First Canadian company to win international medical device design and development award”, The Health Technology Exchange, Toronto, ON, August 24, 2010 (Coverage of PTR/LUM dental caries instrumentation technology: The Canary System).
12. “QDT’s Canary System wins International Medical Device Design and Development award”, Dental Tribune (“The World’s Dental Newspaper”), Aug. 27, 2010.
13. “Fighting Tooth Decay. A new way of peering inside teeth”, Leading Edge article, UofT Magazine, Summer 2011, pp. 17-18.
14. “Sweet beams: Lasers to measure blood sugar: Technique shows early promise in gauging diabetics’ glucose levels”, Science News, Web edition: Thursday Sept. 29, 2011, Article by Devin Powell. [http://www.sciencenews.org/view/generic/id/334827/title/Sweet\\_beams\\_Lasers\\_to\\_measure\\_blood\\_sugar](http://www.sciencenews.org/view/generic/id/334827/title/Sweet_beams_Lasers_to_measure_blood_sugar)
15. “Sweet beams: Lasers to magnitude blood sugar”, Technology Information, October 2, 2011.
16. T. Goodman, “Laser beams detect blood glucose in early experiments”, Inventorspot, Oct. 03 2011, [http://inventorspot.com/articles/laser\\_beams\\_detect\\_blood\\_glucose\\_early\\_tests](http://inventorspot.com/articles/laser_beams_detect_blood_glucose_early_tests)
17. N. Guttridge, “Lasers used to measure blood sugar levels”, Nerditorial, Oct. 8, 2011, <http://www.nerditorial.com/featuredarticles/lasers-used-to-measure-blood-sugar-levels.html>
18. J. Fang, “Measuring blood sugar with laser beams,” Smartplanet, Oct. 13, 2011, <http://www.smartplanet.com/blog/rethinking-healthcare/measuring-blood-sugar-with-laser-beams/7080>
19. N. Guttridge, “Blood sugar measured by lasers,” Felix, Oct. 14, 2011, [http://felixonline.co.uk/archive/IC\\_2011/2011\\_1497\\_A.pdf](http://felixonline.co.uk/archive/IC_2011/2011_1497_A.pdf)
20. Diabetes Forum, “Non-invasive blood glucose monitoring”, October 3, 2011. <http://www.diabetesforum.com/diabetes-news/6758-non-invasive-blood-glucose-monitoring.html>
21. Mrs. Moseley’s Class Blog <http://mrsmosleyanatomy.edublogs.org/2011/10/07/sweet-beams-lasers-to-measure-blood-sugar-2/>
22. “Cavity Catchers”, Reader’s Digest February 2012, p. 26. Article by Chantal Braganza on our dental caries diagnostic imaging research with the “photothermal imaging radar”.

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23. "Interview with Andreas Mandelis", June 2012 by Bela Joos, Editor, Physics in Canada Vol. **68**, No. 3, July – Sept. 2012, pp. 162 – 168; on the occasion of the awarding of the CAP-INO Medal for Outstanding Achievement in Applied Photonics.
24. "*Toronto Killam Prize winners trap light elastic*", Interview with the Toronto Star (Antonia Zerbisias), April 4, 2014, on account of the announcement of the Canada Council of the Arts of the awarding of the 2014 Killam Prize in Engineering to Professor Andreas Mandelis.  
Toronto Star, GTA Section, article published on Wednesday April 9, 2014.  
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25. "*Presenting the Killam Winners*", CBC radio "Ideas" interview with Paul Kennedy and Nicola Luksic, May 30, 2014, On the occasion of the announcement of the Canada Council of the Arts 2014 Killam Prizes, and on account of the awarding of the 2014 Killam Prize in Engineering to Professor Andreas Mandelis.  
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26. "Wo kein Licht zuvor gewesen ist. Photothermische Kohärenz-Tomographie liefert tiefe dreidimensionale Einblicke in opake Gewebe und Materialien", Article by Dirk Eidemüller, German science news agency: Wissenschaft aktuell Pro-Physik.de, July 08, 2014, on the occasion of the publication of the paper by S. Kaipilavil & A. Mandelis: Truncated-correlation photothermal coherence tomography for deep subsurface analysis, Nat. Photon., online 29. Juni 2014; DOI: 10.1038/nphoton.2014.111.  
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27. "Two lasers boost photoacoustic sensitivity", Article by Jude Dineley on the occasion of the publication of our article "Wavelength-Modulated Differential Photoacoustic Spectroscopy (WM-DPAS) for noninvasive early cancer detection and tissue hypoxia monitoring", J. Biophotonics, doi/10.1002/jbio.201500131; MedicalPhysicsWeb, July 22, 2015. <http://medicalphysicsweb.org/>
28. "Wafer Processing: Surface Preparation for Low Temperature CVD Si Epitaxy Processing", R. Pagliaro, R P Innovative Engineering Solutins , LL, Mesa , AZ. Semiconductor Digest, July 2019, pp. 44 – 52.
29. "New Imaging Technique Targets Cholesterol in Arterial Plaque", Photonics Media, June 2019  
[https://www.photonics.com/Articles/New\\_Imaging\\_Technique\\_Targets\\_Cholesterol\\_in/p6/v177/i1169/a64823](https://www.photonics.com/Articles/New_Imaging_Technique_Targets_Cholesterol_in/p6/v177/i1169/a64823)
30. "Biomedical Photoacoustics Reverberates in Clinics", Biophotonics Magazine Vol. 26, Issue 7, October 2019,  
[https://www.photonics.com/Articles/Biomedical\\_Photoacoustics\\_Reverberates\\_in\\_Clinics/p1/vo172/i1131/a65094](https://www.photonics.com/Articles/Biomedical_Photoacoustics_Reverberates_in_Clinics/p1/vo172/i1131/a65094)  
pp. 29-33

## VI. PRESENTATIONS

### VI-1. INVITED (default status), PLENARY AND KEYNOTE PRESENTATIONS

#### ***Lifetime Invited, Plenary and Keynote presentations to-date:***

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*(Including Keynote, Plenary and Guest and Distinguished Guest Lecturer talks at International Meetings)*

1. Invited seminars on "Photothermal Wave Sciences: An Overview", Department of Physics and Mathematics, University of Crete; and Research Center of Crete: Institute of Electronic Structure and Laser; Heraklion, Crete, Greece; August 20-22, 1984.
2. Eastman Kodak Company, Analytical Sciences Division Labs, Rochester, New York; February 20, 1986; "Photothermal Deflection Spectroscopy (PDS) and Its Applications to the Optical and Optoelectronic Characterization of Semiconductors".
3. "Fundamental Theoretical Aspects of Thermal Wave Physics", Review of Progress in Quantitative NDE, August

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- 3-8, 1986; University of California, San Diego. Paper Tu. VIII.4
4. "Inspection in the Semiconductor Industry", Meeting on Industrial Inspection; B.C. Research Council, Vancouver, June 25-26, 1987.
  5. "Frequency Modulation Time Delay Photopyroelectric Spectrometry", 5th International Topical Meeting on Photoacoustic and Photothermal Phenomena, July 27-30, 1987; Heidelberg F.D.R. Paper ThA1.
  6. "Photopyroelectric Spectroscopic ( $P^2ES$ ) QNDE of a-Si:H Thin Semiconducting Films on Quartz", Review of Progress in Quantitative NDE, July 31-August 5, 1988; University of California, San Diego, Paper XXX.2.
  7. "Frequency-Modulated (FM) Time-Delay-Domain Photothermal Spectrometry: Principles, Instrumentation and Applications to Solids", Heraeus Foundation Conference on Photoacoustic, Photothermal and Photochemical Processes in Gases and at Surfaces and Thin Films, Bad Honnef, FRG, November 21-24, 1988.
  8. "Laplace Thermal-Wave Physics: A New Theory of Photothermal Wave Diffraction and Interference in Condensed Media", Lasers '88; Lake Tahoe, NV, U.S.A., December 5-9, 1988.
  9. "Photopyroelectric Imaging Instrumentation and Spatially Resolved Measurements", American Physical Society Meeting, March 20-24, 1989, St. Louis, MO., paper I5.3 (Presented by M. Mieszkowski).
  10. "Laser-photothermal Wave Diffraction and Interference in Condensed Media: Theory and Experiment", ETH Zurich, Laser Seminar Series, January 16, 1989.
  11. "Semiquantitative Analysis of the Kinetic Mechanism of Hydrogen Detection by a Palladium-Coated Photopyroelectric Detector", Sixteenth Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, FACSS XVI, Chicago, IL, Paper #816, October 1-6, 1989.
  12. "Impulse Response Photothermal Instrumentation and Applications", American Physical Society Meeting, March 12-16, 1990, Anaheim, CA, Paper I4-4 (Presented by S. Peralta).
  13. Series of Research Seminars titled "Photoacoustic and Photothermal Spectroscopy and Detection in Condensed Phases. Part I", Dept. of Physics, Katholieke Universiteit Leuven, Belgium; March 28-April 13, 1990.
  14. "Photothermal-Wave Diffraction and Interference in Condensed Media; Theoretical Formulation and Experimental Evidence in Aluminum", Department of Physics, Royal Military College of Canada, Kingston, Ontario, February 8, 1990.
  15. Series of Research Seminars titled "Photoacoustic and Photothermal Spectroscopy and Detection in Condensed Phases. Part II", Dept. of Physics, Katholieke Universiteit Leuven, Belgium; June 3-July 13, 1990.
  16. **(Plenary Speaker)**: "Quantitative Diffuse Reflectance and Transmittance of Powders", 5th International Diffuse Reflectance Conference, August 12-17, 1990: Chambersburg, Penn., USA.
  17. "Quantitative Diffuse Reflectance and Transmittance Photopyroelectric Spectroscopy of Powders", Seventeenth Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, FACSS XVII, Cleveland, OH, Paper #864, October 7-12, 1990.
  18. "Quantitative Diffuse Reflectance and Transmittance Spectroscopy of Powders", 42nd SE/46th SW Meeting of the Am. Chem. Soc., New Orleans, LA, Paper #72, December 5-7, 1990.
  19. "Photoacoustic Frequency-Domain Depth Profiling of Continuously Inhomogeneous Solids. Theory and Quantitative Profilometry of Octylcyano-Biphenyl (8CB) Liquid Crystals", 121st Meeting of the Acoust. Soc. Am., Baltimore, MD, Paper #4PA4, April 29 - May 3, 1991.

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20. "Photopyroelectric Pd-PVDF Hydrogen Sensor", 74th Canadian Chem. Conf., Hamilton, ON, Paper #AN-A2-9, June 2-6, 1991.
21. "Hamilton-Jacobi Theory of Thermal Wave Physics Applications", Physical Chemistry Colloquium, Brown University, Providence, R.I., Chemistry Dept.; May 3, 1991.
22. "Photothermal Detection at Surfaces and Interfaces: Development in Non-Conventional Diagnostics", 7th International Topical Meet. Photoacoustic Photothermal Phenomena, , Holland, August 26-30, 1991.
23. **(Principal Lecturer)** "Thermal Wave-based Materials Characterization and Non-destructive Evaluation; Critical Review", NATO Advanced Study Institute on High Temperature Superconductors-II: Physics and Materials Science, August 18-31, 1991, Halkidiki, Greece.
24. "Photothermal Rate-Window Spectroscopy", American Physical Society Meeting, March 16-20, 1992, Indianapolis, IN, Paper K3-3 (Presented by Z.H. Chen).
25. "Physical Fundamentals of Thermal Wave Science", 1992 Gordon Res. Conf. on Photoacoustic and Photothermal Phenomena, Colby Sawyer Coll., New London, N.H. June 8-12, 1992.
26. "Quantitative Diffuse Reflectance and Transmittance Photopyroelectric Spectroscopy of Silica Derivatized Powders", 75th Can. Chem. Conf. Exhibition, Edmonton, May 31-June 4; Symposia on Photoacoustic IR Spectroscopy.
27. **(Keynote Lecturer)** "Non-Conventional Photothermal Diagnostics", Workshop on Photoacoustics, International Laser Center and Russian Academy of Sciences, Moscow State University, Moscow, Russia, May 11-16, 1992.
28. "Photothermal Non-Destructive Depth Profilometry of Surface Layer Inhomogeneities in Opaque Solids", Can. Assoc. Res. Non-Destr. Eval. Meeting, Boucherville, Quebec, May 20-21, 1992.
29. "Perturbation Theoretical Approach to the Generalized Kubelka-Munk Problem in Non-Homogeneous Optical Media", 6th International Diffuse Reflectance Conference, Chambersburg, Penn., USA, August 9-14, 1992.
30. "Photoacoustic Frequency-Domain Depth Profiling of Continuously Inhomogeneous Solids. The Inverse Problem", 14th International Congress on Acoustics, Beijing, China, Sept. 3-10, 1992.
31. "Rate-Window Thermomodulation Spectrometry", International Workshop Physical Acoustics, Nanjing Univ., China, Sept. 14-17, 1992.
32. "Advances in Photothermal Solid-State Device Technology: Hydrogen-Gas Pd-PVDF Junction Photopyroelectric Sensor", Physics Colloquium, Univ. Quebec Trois Rivieres, P.Q., Physics Dept. November 24, 1992.
33. **(Invited Tutorial)** A. Mandelis with J. Power, "Random Signal Generation, Correlation and Spectral Analysis and its Instrumental Applications to Photoacoustic/Photothermal Nondestructive Evaluation", Tutorial T2. Amer. Phys. Soc. Meeting, March 21-26, 1993, Seattle, WA.
34. "An Overview of Photothermal Research in the Photothermal and Optoelectronic Diagnostics Laboratories at the University of Toronto", Colloquium; Inst. For Optics and Quantum Electronics, Friedrich-Schiller University, Jena, Germany, June 7, 1993.
35. "Thermal-Wave Techniques for *in-situ* control in semiconductor manufacturing", 1st Seminar on "In-situ Film Thickness and Temperature Measurement Systems for Semiconductor Manufacturing", Fraunhofer Inst. Integrated Circuits (FhG-11S), Erlangen, Germany, June 3-4, 1993.

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36. "Purely thermal-wave-based Photopyroelectric Gas Sensor: Characterization and use as hydrogen and helium gas detector under ambient conditions" Amer. Chem. Soc. Meeting, Symposium of Div. Chem. Health Safety, Chicago, IL, July 21, 1993.
37. "Computational Thermal-Wave Slice Tomography with Back-Propagation and Transmission Reconstructions", 20th Ann. Rev. Progr. Quantitative NDE, Session 26, Bowdoin Coll., Brunswick, Maine, Aug. 1-6, 1993.
38. "Quantum Efficiency and Metastable Lifetime Measurements in Solid-State Laser Materials via Lock-in Rate-Window Infrared Photothermal Radiometry: Technique and Applications to Ruby ( $\text{Cr}^{3+}:\text{Al}_2\text{O}_3$ )", Paper #631, 20th Ann. Meet. Fed. Anal. Chem. Spectrosc. Soc. (FACSS XX), Detroit, MI, Oct. 17-22, 1993.
39. **(Invited Tutorial Introduction)** "Time, Frequency and Hybrid Spectral Domain Photothermal Instrumentation and Measurement methodologies", 8th Int. Topical Meet. Photoacoustic Photothermal Phenomena, Jan. 22-25, 1994, Guadeloupe (France).
40. "Investigation of Competitive Chemical and Thermal-Wave Effects in Photopyroelectric  $\text{H}_2$  Sensors", 6th Canadian Hydrogen Workshop, February 23-25, 1994, Victoria, B.C., Canada.
41. "Laser Photothermal Techniques", 12th Symposium Thermophysical Properties, June 19-24, 1994, Boulder, CO.
42. Thermal-Wave Resonator Cavity: Characteristics and Use as a Sensor, 139 W.E. Heraeus Seminar on Transient Laser Gratings and Waves at Surface, Bad Honnef, Germany, January 23-26, 1995.
43. Advances in Photothermal Diagnostic Science at the University of Toronto: Techniques, Sensors and Materials Science, Instituto Politecnico Nacional, CINVESTAV, Dept. of Physics, Mexico City, Mexico, December 12-16, 1994.
44. Novel Techniques of Infrared Photothermal Radiometry for Manufacturing Applications, IBM Almaden Res. Labs, Manufacturing Research Seminar Series, San José, CA, March 22, 1995.
45. Maximum Dynamic Range, Thermal-Wave Based Pyroelectric Gas Sensor Devices, 78th Canadian Society for Chemistry Conference and Exhibition, Univ. Guelph, May 28-June 1, 1995.
46. Photopyroelectric-Quantum-Yield Spectroscopy and Quantum-Mechanical Photoexcitation-Decay Kinetics of the  $\text{Ti}^{3+}$ : Ion in  $\text{Al}_2\text{O}_3$ ", 41st Int. Conf. Anal. Sci. Spectrosc., Windsor, ON, August 15, 1995.
47. "Advances in Photothermal Science at the University of Toronto: Techniques, Sensors and Materials Science", Univ. of Cairo, National Institute for Laser Enhanced Sciences, Cairo, Egypt, February 26, 1996.
48. "Photothermal Depth Profilometry and the Inverse Problem", Univ. of Cairo, National Institute for Laser Enhanced Sciences, Cairo, Egypt, February 29, 1996.
49. **(Keynote Speaker)** "The Structure of the Ontario Centres of Excellence and Laser Applications Programs within OLLRC and MRCO", Workshop on Laser Science, National Institute for Laser Enhanced Sciences, Univ. of Cairo, Egypt, March 2, 1996.
50. "Novel, Powerful and Ultrasensitive Photothermal Diagnostic Techniques: Shaping Up the State-of-the-Art in Industrial Physics in the 1990's", Natural Sciences Colloquium, Univ. of Cyprus, Nicosia, March 26, 1996.
51. "A Generalized Photoacoustic Methodology for Thermal Diffusivity Profile Reconstruction in Two-Layered Solids", Forum Acusticum 1996, Antwerp, Belgium, April 1-4, 1996, Paper 425.
52. "Novel, Powerful and Ultrasensitive Photothermal Non-Destructive Diagnostic Techniques for Materials Science in the 1990's", AGIL '96: The First Conference of the Israel Materials Union, April 29-30, 1996, Nathania, Israel.



53. **(Guest Lecturer)** "New Methods for Ultra-Sensitive Non-Destructive Evaluation (NDE)", Dept. of Materials and Interfaces, Weitzmann Institute of Science, Rehovot, Israel, April 28, 1996.
54. "Laser Photothermal Rate-Window and Radiometric Deep-Level Transient Spectroscopy of Semiconductors: State-of-the Art", Ruprecht-Karls-Universität Heidelberg, Physikalisch-Chemisches Institut, Heidelberg, Germany, May 6, 1996.
55. "Advances in Novel Photothermal Non-Destructive Diagnostic Techniques and Instrumentation for Manufacturing Applications at the University of Toronto", Colloquium, Forschungszentrum Karlsruhe, Institute für Instrumentelle Analytik, Karlsruhe, Germany, May 7, 1996.
56. "Non-Destructive Testing and Evaluation of Rail Tracks by a Photothermal Techniques", Material Movement Within a Steel Plant, Nashville, Tenn., October 6-8, 1996.
57. "Noncontact Photothermal Depth Profiling of Continuously Inhomogeneous Semiconductors", 23rd Annual Review of Progress in QNDE, Brunswick, Maine, July 28-August 2, 1996. (Presented by A. Salnick).
58. "Noncontacting Photothermal Radiometry of SiO<sub>2</sub>/Si MOS Capacitor Structures", 23rd Annual Review of Progress in QNDE, Brunswick, Maine, July 28-August 1, 1996. (Presented by A. Salnick).
59. "Infrared Photothermal Radiometric Deep-Level Transient Spectroscopy of Semiconductors", 9th Int. Conf. on Photoacoustic and Photothermal Phenomena, Invited Structured Session on: NDE and Characterization of New Materials, Nanjing, China, June 27-30, 1996.
60. "Remote Laser-Induced Infrared Radiometric Non-Destructive Monitoring of Industrial Semiconductor Substrates and Devices", American Physical Society Meeting, March 17-21, 1997, Kansas City, MO, Paper G4-4 (Presented by A. Salnick).
61. "Development of a Dual Photopyroelectric/Optical-Transmittance Hydrogen Sensor", Symposium on "Chemical Sensors and Biosensors" of the 80th Canadian Society for Chemistry Conference and Exhibition, Windsor, ON, June 1-4, 1997.
62. "Electronic Materials Laser Photothermal NDE: The State-of-the Art", Session on *Electronic Materials*, 3rd Gordon Research Conference on Photoacoustic and Photothermal Phenomena, Oxford, UK, September 14-19, 1997.
63. "Thermal-Wave Resonant Cavity: An Ultrasensitive Thermal Diffusivity Sensor", 13th Symposium on Thermophysical Properties, Boulder, CO, June 22-27, 1997.
64. **(Keynote Speaker)** "Advances in Lock-in Amplifier Signal Processing Optimization", III International Workshop on *Advances in Signal Processing for Non-Destructive Evaluation of Materials*, Univ. Laval, Quebec City, Quebec, August 5-8, 1997.
65. "Advances in Photothermal Diagnostic Science at the University of Toronto: Techniques, Sensors and Materials", Invited Colloquium Presentation, Applied Physics Laboratory, and Johns Hopkins University, Laurel, MD, November 5, 1997.
66. "A Novel Ultra-sensitive Thermal-Wave Resonant Cavity Sensor: Principles and Applications to the In-Situ Measurement of Thermophysical Properties of Gases and Vapors", Syncrude Research Center, Edmonton, AB, January 14, 1998.
67. **(Plenary Speaker)** "Laser Infrared Photothermal Radiometry: Physical Principles and Non-Destructive Characterization of Materials and Processes in the Metals, Coatings and Electronics Industries", XVIII National Congress of the Mexican Society of Surface Science and Vacuum, Puerto Vallarta, Mexico, Sept. 28- October 1, 1998.
68. "Nonlinear Photothermal Response in 3D Geometry: A General Theoretical Model and Experimental Results for

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- Tungsten”, (with Salnick, A., Opsal, J., Rosencwaig, A); Paper 20.9, 25th Annual Review of Progress in QNDE, Snowbird, UT, July 19-24, 1998.
69. **(Keithley Award Invited Speaker)** “A Century of Photothermal and Photoacoustic Spectroscopies and Microscopies”, Paper LC17 4, 1999 Centennial Meeting of the American Physical Society, Atlanta, GA, March 20-26, 1999.
  70. **(Plenary Lecture)** “Diffusion-Wave Diagnostics: Emerging Quality-Control Technologies for Materials NDE / NDT”, 2<sup>nd</sup> Int. Conf. on “Emerging Technologies in NDT”, Athens, Greece, May 24-26, 1999.
  71. “Thermal-Wave Interference and Boundary Reflection: Fact or Fiction?”, Fourth Gordon Research Conference on Photoacoustic and Photothermal Phenomena, New London, NH, June 27- July 2, 1999.
  72. “Photothermal Thin-Film Diagnostics with Novel Photopyroelectric Methodologies”, 9<sup>th</sup> European Meeting on Ferroelectricity, EMF-9, Prague, Czech Republic, July 12-16, 1999.
  73. “Modulated Laser Photothermal and Luminescence Techniques for Dental Caries Diagnostics”, SPIE Int. Symp. Biomedical Optics, BIOS 2000, San Jose, CA, January 22-28, 2000.
  74. **(Keithley Award Invited Speaker)** “Novel Lock-In Waveform Techniques for Measurement Signal-to-Noise Ratio and Dynamic-Range Enhancement in Highly Noised Experiments”, Paper I6.04, Meeting of the American Physical Society, Minneapolis, MN, March 20-24, 2000.
  75. “Novel Modular Thin-Film Hydrogen Sensors based on Optical and Photothermal Signal Modulation”, Workshop on *Hydrogen and Diamond Related Topics*, Institute for Materials Research, Limburgs University Center, Diepenbeek-Hasselt, Belgium, 4<sup>th</sup> March 2000,
  76. “Thermal Diffusivity Depth Profile Reconstruction of Rough Surfaces by Heuristically Eliminating Roughness”, European Commission HARDPHOTOTEC Workshop on *Hardness Measurements on Steel: Conventional and Alternative Non-Destructive Methods*, Ispra, Italy, 13 – 14 March, 2000. (Presented by L. Nicolaidis).
  77. **(Plenary Lecture)** “Novel Lock-In Waveform Techniques for Measurement Signal-to-Noise Ratio and Dynamic-Range Enhancement in Highly Noised Experiments” 11<sup>th</sup> Int. Conf. Photoacoustic Photothermal Phenomena, Kyoto, Japan, June 25-29, 2000.
  78. “Thermal-Wave Depth Profilometric Non-Destructive Evaluation of Automotive Coatings and Steels”, Symposium on Physical Sciences and Advanced Vehicle Technologies, June 7-8, 2000, York University, Toronto, ON
  79. “Novel Common-Mode Rejection Lock-in Amplifier Analytical Spectrometry and its Applications to photothermal Chemometric Systems”, Paper RAP03, 2000 Federation of Analytical Chemistry and Spectroscopy Society (FACSS) Conference, Sept. 24-28, 2000, Nashville, TN
  80. **(Plenary Lecture; (Conferencia Magistral))** “Diffusion Waves and their Uses”, CINVESTAV, Mexico City, December 5, 2000.
  81. Short course to research staff: “Thermal Waves and their Uses”, CINVESTAV, Queretaro, Mexico, December 6-8, 2000.
  82. “Experimental and Computational Aspects of Optical Property Determination of Turbid Media using Frequency-Domain Laser Infrared Photothermal Radiometry”, session MO-A5, Canadian Association of Physicists (CAP) Congress in Victoria, BC, 18 June 2001.
  83. “Lock-in Common Mode Rejection Demodulation: A Novel Background-Suppression Signal Generation Methodology” Canadian Association of Physicists Congress, Victoria, BC, June 17-21 (2001).
  82. “Ion-Implantation Dose High-Resolution Monitoring in Si Wafers using Laser Infrared Photothermal Radiometry with Lock-In Common-Mode Rejection Demodulation” Tutorial T2.3, IV Int. Workshop on Advances in Signal

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- Processing for Non-Destructive Evaluation of Materials”, Laval University, Quebec City, August 7-10 (2001).
83. “Progress in Theoretical, Experimental and Computational Investigations in Turbid Tissue Phantoms and Human Teeth using Laser Infrared Photothermal Radiometry”, ThermoSense XXIV, Orlando, FL, 1-5 April 2002 (paper 4710-42).
  84. “Andrew C. Tam: Memories of the Man, the Scientist and the Friend”, in Laser Ultrasonics, 2001 Gordon Conference on Photoacoustic and Photothermal Phenomena, Queen’s College, Oxford, UK, August 19-24 (2001).
  85. **(Keynote Speaker)** “Photo-Carrier Radiometry of Semiconductors: A Novel Powerful Optoelectronic Diffusion-Wave Technique for Silicon Process Non-Destructive Evaluation”, 3<sup>rd</sup> Int. Conf. On “Emerging Technologies in Non-Destructive Testing”, Thessaloniki, Greece, May 26-28 (2003).
  86. “Advances in Photothermal Radiometry and Luminescence Diagnostics of Natural Carious and Artificial Sub-surface Lesions in Human Teeth”, Gordon Research Conference on Photoacoustic and Photothermal Phenomena, Colby-Sawyer College, New London, NH, June 8-13 (2003).
  87. “Frequency Domain Infrared Photothermal Radiometry and Modulated Laser Luminescence”, The Indiana Conference, School of Dentistry, Indiana University – Purdue University, Indianapolis, May 21 – 23 (2003); presented by Stephen H. Abrams.
  88. “Photothermal Diagnostics of Engineering Materials”, Dept. of Physics, Festkoerperspektroskopie III, Ruhr Univ. Bochum, Germany; Oct. 24, 2003.
  89. “Photo-Carrier Radiometry of Semiconductors”, Dept. of Physics, Festkoerperspektroskopie III, Ruhr Univ. Bochum, Germany; Nov. 7, 2003.
  90. S. Abrams and A. Mandelis, “Frequency Domain Infrared Photothermal Radiometry and Modulated Laser Luminescence”, The Indiana Conference, School of Dentistry, Indiana University – Purdue University, Indianapolis, May 21 – 23 (2003).
  91. “Laser photothermal metrologies for the semiconductor fabs”, KLA Tencor, San Jose, CA; Nov. 19, 2003.
  92. “Photo-carrier Radiometry metrology for Si ion implantation monitoring”, Therma-Wave, Inc., Fremont, CA; Nov. 20, 2003.
  93. “Laser-induced Diffusion-Wave Science and its Applications”, Graduate Faculty Seminar, Solid-State Physics Dept., Ruhr Univ. Bochum, Germany; January 22, 2004.
  94. “Biomedical photothermal and photothermoacoustic diagnostics for cancer imaging and dental caries prevention”, Dept. of Physics, Festkoerperspektroskopie III, Ruhr Univ. Bochum, Germany; January 23, 2004.
  95. “Laser-Induced Diffusion-Wave Diagnostic Technologies: Go where no light has gone before”, Physics Dept., Univ. of Cyprus, Nicosia, Cyprus; March 1, 2004.
  96. “Diffusion-Wave Physics and Industrial and Biomedical Applications”, Dept. of Physics, University of Athens, Panepistimioupolis Athens, Greece; April 15, 2004.
  97. “Dental Depth Profilometric Diagnosis of Pit and Fissure Caries using Frequency-Domain Infrared Photothermal Radiometry and Modulated Laser Luminescence”, Academic Center for Dental Sciences, Free University of Amsterdam, Amsterdam, the Netherlands; April 20, 2004.
  98. Y. Fan, A. Mandelis, G. Spirou, A. Vitkin and W. Whelan, “Three-dimensional photothermoacoustic depth profilometric imaging by use of linear frequency sweep heterodyne method”, oral paper 5320-17, SPIE BIOS Conf. # 5320, Jan. 25 – 27, 2004, San Jose, CA.

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99. A. Mandelis, Y. Fan and A. Vitkin, "Laser Photo-thermo-acoustic Frequency Swept Heterodyned Lock-in Depth Profilometry for Three-Dimensional Sub-surface Tissue Imaging", Instr. and Techn. in Biomed. Physics I, Canadian Association of Physicists Congress, June 13-16, 2004; Winnipeg, Manitoba.
100. **(Plenary Speaker)** "Photo-Carrier Radiometry of Electronic Solids: A Powerful New Optoelectronic Diffuse Carrier-Density-Wave Methodology" paper 10L-01, 13<sup>th</sup> Int. Conf. Photoacoustic Photothermal Phenomena, Rio de Janeiro, Brazil; July 5-8, 2004.
101. A. Mandelis, D. Shaughnessy, J. Tolev and J. Meijer, "Two-beam cross-modulation photo-carrier radiometry of electronic solids. Principles and applications to ion-implanted silicon", Canadian Association of Physicists Congress, Vancouver, BC, June 5 – 8, 2005.
102. A. Mandelis, C.H. Wang, I. Delgadillo-Holfort, M. Pawlak and J. Pelzl, "Contactless characterization of photo-carrier recombination processes in Si using rate-window photo-carrier radiometry", Canadian Association of Physicists Congress, Vancouver, BC, June 5 – 8, 2005.
103. **(Plenary Speaker)** A. Mandelis, "Photo-Carrier Radiometry", Session on Non-Destructive Evaluation, June 30, 2005; Gordon Research Conference on Photoacoustic and Photothermal Phenomena, Trieste, Italy, June 26 – July 1, 2005.
104. **(Keynote Presentation; Special Events Session)** A. Mandelis, "Trends in biothermophotonics and bioacoustophotonics of tissues", SPIE Int. Conf. on Optics and Optoelectronics (Acousto-optics and Photoacoustics), Warsaw University of Technology, Warsaw, Poland, August 28 – Sept. 2, 2005.
105. "Laser Bioacoustophotonics", Presentation to Depts. of Physics and Biophysics, Nicolaus Copernicus University, Torun, Poland, August 31, 2005.
106. "Trends in Bioacoustophotonic Imaging of Tissues", Seminar Series in Analytical Chemistry, Dept. of Chemistry, Univ. of Toronto, March 30, 2006.
107. **(OCE student poster competition accompanied with a \$2,000 award)** A. Matvienko, R. Jeon, A. Mandelis and S. Abrams, "Biothermophotonic method for the diagnosis of incipient dental caries", Discovery 2006 Conference – Ontario Centers of Excellence, Toronto, Canada, February 2006. Top award talk.
108. "Bioacoustophotonic Imaging of Tissues", Analytical Chemistry Graduate Seminar, Dept. of Chemistry, University of Toronto, March 30, 2006.
109. "Photothermoacoustic Imaging of Turbid Media", Biophotonics group research seminar series, UofT – Ryerson Univ., Princess Margaret Hosp., May 11, 2006.
110. "Bioacoustophotonic Depth Selective Imaging of Turbid Media and Tissues. Instrumentation and Measurements", Special Physics-in-Canada session PiC-II, 2006 CAP Congress, St. Catharines, ON, June 12, 2006.
111. A. Matvienko and A. Mandelis, "Characterization of Dental Demineralization using a Biothermophotonic Technique", Sixteenth Symposium on Thermophysical Properties, Boulder, CO, July 30 – Aug. 4, 2006.
112. **(Keynote Presentation on the occasion of the 20<sup>th</sup> Anniversary of the Institute of Physics of the National Polytechnic of Mexico in Guanajuato)** A. Mandelis, "*Diffusion-Wave Science and Technologies: They go where no light has gone before*". Sept. 28 - 29, 2006. Other keynote speakers included the Nobel laureates Leon Lederman, Illinois Institute of Technology, and Charles H. Townes, University of California.
113. A. Mandelis, "Dental Biothermophotonics: How Photothermal Methods are winning the Race with X-Rays for Dental Caries Diagnostic Needs of Clinical Dentistry", 14<sup>th</sup> Int. Conf. Photoacoustic & Photothermal Phenomena, Cairo, Egypt, January 6 – 9, 2007, invited talk I 13.5.
114. S. A. Telenkov and A. Mandelis, "Fourier-Domain Methodology for Depth-Selective Photothermoacoustic Imaging of Tissue Chromophores", 14<sup>th</sup> Int. Conf. Photoacoustic & Photothermal Phenomena, Cairo, Egypt, January 6 – 9,

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2007, invited talk I 13.4.

115. A. Mandelis and S. Telenkov, "Fourier-Domain Bioacoustic Sub-surface Depth Selective Amplitude and Phase Imaging of Turbid Phantoms and Biological Tissue" APS March meeting , Paper B38.0001, Denver, CO, March 5-9, 2007.
116. A. Mandelis and J. Xia, "Deep Level Photo-Thermal Spectroscopy", 4<sup>th</sup> Int. Conf. Emerging Technologies in Non-Destructive Testing, April 2-4, 2007 (Stuttgart, Germany).
117. A. Mandelis, "Biophotocoustic Depth Selective Imaging of Turbid Media and Tissues: Instrumentation and Measurements"; and "Dental Biothermophotonics: A Quantitative Photothermal Analysis of Early Dental Demineralization", Optical and Ultrasonic Technologies for Biomedical Applications, NRC Boucherville, Quebec, May 4 (2007).
118. A. Mandelis, R. Jeon, A. Matvienko and S. Abrams, "Dental Thermophotonics : Laser Photothermal Methods vs. X-rays in the Race for Dental Caries Diagnostics in Clinical Dentistry", 2007 Canadian Association of Physicists (CAP) Congress, paper TU-P10-1, June 17 – 20, 2007, Univ. of Saskatchewan, Saskatoon, Canada.
119. A. Mandelis, "Diffusion-Wave Science and Diagnostic Technologies" Summer School 2007, National Research Center in Natural Sciences "Demokritos", Athens, Greece, July 16 – 20, 2007.
120. A. Mandelis, "Photo-Carrier Radiometry and Deep-Level Photo-Thermal Spectroscopy", Summer School 2007, National Research Center in Natural Sciences "Demokritos", Athens, Greece, July 16 – 20, 2007.
121. A. Mandelis, "Dental Thermophotonics: how laser photothermal methods are winning the race with x-rays in detecting dental cavities", Professional Engineers of Ontario, Etobicoke Chapter, Islington Golf Country Club, November 7, 2007.
122. A. Mandelis, "'Deep Level Photo-Thermal Spectroscopy: Physical Principles and Optoelectronic NDE of Multiple Trap States in Semiconductors", Session on Non-Destructive Evaluation, June 30, 2005; Gordon Research Conference on Photoacoustic and Photothermal Phenomena, February 10-15, 2008, Crowne Plaza, Ventura, CA, USA.
123. A. Mandelis, "Dental thermophotonics", 10<sup>th</sup> Spring School in Acousto-optics and Photoacoustics, Gdansk, Poland, May 12-15, 2008.
124. A. Mandelis, "Investigation of Demineralization and Remineralization of Human Teeth Using Infrared Photothermal Radiometry and Modulated Luminescence", Canadian Association of Physicists Annual Congress, June 8 – 11, 2008; Paper TU-A5-1, Biomedical Instrumentation, June 10 (Laval University, Quebec City).
125. S. Telenkov and A. Mandelis, "Photothermalacoustic Imaging of breast tissue: numerical simulation and detection analysis", Canadian Association of Physicists Annual Congress, June 8 – 11, 2008 Paper TU-A5-2, Biomedical Instrumentation, June 10 (Laval University, Quebec City).
126. A. Matvienko, A. Mandelis, R. Jeon, S.H. Abrams, and B.T. Amaechi, "Quantitative Analysis of Incipient Dental Mineral Loss", International Association of Dental Research (IADR) Conference, July 2-5, 2008 Paper 0527, Convention Centre, Toronto, ON, Canada.
127. R. Jeon, A. Hellen, A. Matvienko, A. Mandelis, S.H. Abrams, and B.T. Amaechi, "Thermophotonic Detection of Demineralized Root and Enamel Lesions", International Association of Dental Research (IADR) Conference, July 2-5, 2008 Paper 0528, Convention Centre, Toronto, ON, Canada.
128. A. Hellen, R. Jeon, S.H. Abrams, A. Mandelis, and B.T. Amaechi, "Photothermal and Modulated Luminescence Detection of Demineralized Tooth Restoration Interfaces", International Association of Dental Research (IADR) Conference, July 2-5, 2008 Paper 0529, Convention Centre, Toronto, ON, Canada.

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129. A. Mandelis, "Theoretical and Experimental Investigation of Demineralization and Remineralization of Human Teeth Using Infrared Photothermal Radiometry and Modulated Luminescence", 2008 Int. Conf. on Advanced Laser Technologies (ALT), September 13 – 18, 2008 Siofok, Hungary.
130. A. Mandelis, "Two-beam cross-modulation photocarrier radiometry. Principles and contrast amplification in semiconductor subsurface imaging", Virtual Conference on Nanoscale Science and Technology 2008 (2008 VC-NST), Symposium H: Characterization of Nanostructured Materials for Solar and Optoelectronic Devices, July 24 – 29 Univ. of Arkansas, Fayetteville, AK.
131. A. Mandelis, C. Kwan and A. Matvienko, "Dynamic photophysical processes in laser irradiated human cortical skull bone", SPIE BiOS Conf. # 7166 ("Optics in Bone Biology and Diagnostics") , Paper 7166-10, session 3. Jan. 24 - 29, 2009, Convention Center, San Jose, CA.
132. **(SPIE Distinguished Guest Lecturer)** A. Mandelis, "Photothermoacoustic imaging of biological tissues: Signal generation and maximum depth characterization comparison of time- and frequency-domain measurements", University of Connecticut (Storrs); Lecture sponsored by the UConn SPIE Student Chapter, April 23, 2009.
133. **(Plenary Speaker-Yeram Touloukian Award)** A. Mandelis, "Thirty years of unconventional techniques, instrumentation and measurements in Photothermal Thermophysics", 17th NIST/ASME Symposium of Thermophysical Properties, June 21-25, 2009, Boulder, CO; Monday June 22.
134. A. Mandelis and J. Xia, "Deep Level Photo-Thermal Spectroscopy of Defect States in Semi-Insulating GaAs: A Combined Temperature-, Pulse-Rate- and Time-Domain Study of Defect State Kinetics", 2009 CAP Congress, Moncton, New Brunswick, June 7-10.
135. **(CAP Industrial and Applied Physics Medal Plenary Speaker)** A. Mandelis, "Diffusion-Wave Diagnostic Techniques in Industrial and Medical Physics: They go where no light has gone before!", 2009 CAP Congress, Moncton, New Brunswick, June 7-10.
136. **(Invited Tutorial Lecture)** A. Mandelis and J. Xia, "Broadening effects and ergodicity in Deep-Level Photothermal Spectroscopy of defect states in semi-insulating GaAs: A combined temperature-, pulse-rate-, and time-domain study of defect state kinetics", 15<sup>th</sup> Int. Conf. on Photoacoustic and Photothermal Phenomena, Leuven, Belgium, July 19 – 23, 2009.
137. **International Photoacoustic and Photothermal Association (IPPA) Senior Prize Plenary Lecture.** A. Mandelis, "Highlights of current research at the Center for Advanced Diffusion-Wave Technologies: We go where no light has gone before", 15<sup>th</sup> Int. Conf. on Photoacoustic and Photothermal Phenomena, Leuven, Belgium, July 23, 2009.
138. A. Mandelis, Guest Speaker Invited Lecture, "Diffusion Waves and Applications", Dept. of Mechanical and Materials Engineering,, Univ. of Western Ontario, Oct. 5, 2009
139. A. Mandelis, A. Hellen and Y. Finer, "Photothermal radiometry and modulated luminescence examination of demineralized and remineralized dental lesions", SPIE BiOS Conf. # 7548F ("Optics in Bone Biology and Diagnostics") , Paper 7548F-150, Session 3. Jan. 23 - 28, 2010, Moscone Convention Center, San Francisco, CA.
140. A. Mandelis, "The development of the photoacoustic radar and applications to subsurface depth-selective imaging of biological tissues for early cancerous lesion detection", Ontario-on-a-Chip, University of Toronto, May 20, 2010.
141. A. Mandelis, "Biothermophotonics", First Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena, Center Ettore Majorana, Erice (Sicily, Italy), July 11-18, 2010.
142. S. Telenkov and A. Mandelis, "Photoacoustic sonar: principles of operation and imaging". First Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena, Center Ettore Majorana, Erice (Sicily, Italy), July 11-18, 2010.
143. **(Keynote Plenary Speaker)** A. Mandelis, "Infrared Lock-in Carrierography (Photocarrier Radiometric Imaging) of

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- Semiconductors and Si Solar Cells”, QIRT 2010, The 10th International conference on: Quantitative Infrared Thermography, Quebec City, Canada, July 27-30, 2010.
144. A. Mandelis, A. Hellen, B. Amaechi and Y. Finer, “Quantitative evaluation of demineralization and remineralization of simulated dental enamel caries using photothermal radiometry and modulated luminescence”, 18<sup>th</sup> Int. Conf. on Advanced Laser Technologies (ALT ‘10), September 11 – 16, 2010, Amsterdam, Holland.
  145. **(Keynote Plenary Speaker)** A. Mandelis, “Lock-in Carrierography Photocarrier Radiometric Imaging) of defects and dislocations in industrial Si solar cells”, 30<sup>th</sup> Annual Congress of the Mexican Vacuum Society, September 25 – October 1, 2010, Cancun, Mexico.
  146. A. Mandelis, “Dental Thermophotonics: Dental caries diagnostic imaging and depth profiling in clinical dentistry”, CINVESTAV, Merida, Mexico, Sept. 27, 2010.
  147. **(Seminars in Mechanical and Industrial Engineering, Invited Lecture)** A. Mandelis, “Photothermoacoustic Imaging of biological tissues: Comparison of Time and Frequency-Domain Measurements”, Mechanical and Industrial Engineering, Univ. of Toronto, November 12, 2010.
  148. A. Mandelis, “New biomedical photoacoustic and thermophotonic imagers and biosensors: State of the science and technology”, College of Optics and Photonics (CREOL), University of Central Florida, Orlando, April 7, 2011.
  149. S. Telenkov and A. Mandelis, “Photoacoustic scanning tomography with coded optical excitation: Theory and experiment”, TU-C0220-04, Joint American Association of Physicists in Medicine (AAPM)/COMP Meeting, Vancouver BC, July 31 – Aug. 4, 2011.
  150. A. Mandelis, “High-frequency direct and heterodyne lock-in carrierographic imaging of microcrystalline silicon solar cells”, CAP Congress, Memorial University of Newfoundland (St. John’s, Newfoundland), June 13 – 17, 2011.
  151. A. Mandelis, B. Lashkari and S. Telenkov, “The Biomedical Photoacoustic Radar Imager: Principles, Signal-to-Noise Ratio, Contrast and Resolution”, Session on New Hybrid Modalities in Medical Imaging – Monday June 20, Fields-MITACS Conf. on Mathematics of Medical Imaging, University of Toronto, June 20 – 24, 2011.
  152. S. Telenkov and A. Mandelis, “Frequency-Domain Photoacoustics: Specifics of Signal Processing and Image Reconstruction”, Session on New Hybrid Modalities in Medical Imaging – Tuesday June 21, Fields-MITACS Conf. on Mathematics of Medical Imaging, University of Toronto, June 20 – 24, 2011.
  153. **(First-Prize Winning Poster)** N. Tabatabaei and A. Mandelis, “Thermophotonic Radar Imaging of Turbid Media”, Fields-MITACS Conf. on Mathematics of Medical Imaging, University of Toronto, June 20 – 24, 2011.
  154. A. Mandelis, “Photothermal Thermophysics: techniques for the measurement of thermophysical properties of matter”, 19th European Conf. on Thermophysical Properties, Thessaloniki, Greece, August 28 – Sept. 1, 2011.
  155. **(Leading seminar, Special Session on Photothermal and Photoacoustic Thermophysics)**, A. Mandelis “Biomedical diagnostic techniques and imaging based on photothermal thermophysics: Blood Glucose Biosensor and early dental enamel caries imager”, 19th European Conf. on Thermophysical Properties, Thessaloniki, Greece, August 28 – Sept. 1, 2011.
  156. **(Conference Opening Ceremony Plenary Speaker)** A. Mandelis, “Photoacoustic, Photothermal and Diffusion-Wave Sciences in the 21st Century: Triumphs of the past set the trends for the future”, 16th Int. Conf. on Photoacoustic and Photothermal Phenomena (ICPPP), Merida, Mexico, Nov. 27 – Dec. 1, 2011.
  157. **(APS J. F. Keithley Award for Advances in Measurement Science Lecture Speaker)** A. Mandelis, “Thermophotonic and Photoacoustic Radar Imaging Methods for Biomedical and Dental Imaging”, APS March Meeting 2012, Boston MA, Feb. 27 – March 2, 2012. Session T46: Invited Keithley Award Session.
  158. A. Mandelis, “University of Toronto and the Faculty of Applied Science and Engineering: Facts and Figures of Canada's largest University”, University of Electronic Science and Technology of China (UESTC), Chengdu, March

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- 14, 2012; University-wide seminar.
159. A. Mandelis, "Highlights of current research at the CADIFT: We go where no light has gone before!", UESTC, Chengdu, China, School of Optoelectronic Information, March 15, 2012.
160. A. Mandelis, "Lock-in and heterodyne carrierographic imaging: Dynamic non-destructive inspection methods of optoelectronic materials and devices with applications to quality control of industrial photovoltaic solar cells", Chinese Academy of Sciences, Shuangliu, Chengdu, Sichuan, March 16, 2012.
161. A. Mandelis, "Lock-in imaging techniques for thermal waves and photocarrier waves in solids", Institute of Modern Optical Technologies, Soochow University, Suzhou, Jiangsu, China, March 18, 2012.
162. A. Mandelis, Invited Lecturer, "Lock-in and heterodyne carrierographic imaging: Dynamic optoelectronic diffusion-wave NDT methods with applications to quality control of industrial solar cells", Second Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena: Focus on BIOMEDICAL, NANOSCALE IMAGING and NON DESTRUCTIVE EVALUATION, Center Ettore Majorana in Erice (Sicily, Italy), April 19-26, 2012. Lecture # 3, April 20, 2012.
163. A. Mandelis, Invited Lecturer, "Thermophotonic and Photoacoustic Radar Imaging Methods for Biomedical and Dental Imaging", Second Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena: Focus on BIOMEDICAL, NANOSCALE IMAGING and NON DESTRUCTIVE EVALUATION, Center Ettore Majorana in Erice (Sicily, Italy), April 19-26, 2012. Lecture # 6, April 22, 2012.
164. **(Plenary Speaker)** A. Mandelis, "Thermophotonic and Photoacoustic Radar Methods for Biomedical and Dental Imaging" CAP-INO Medal Talk # 498, CAP Congress 2012, Calgary, AB, June 15 (2012).
165. K. Sreekumar and A. Mandelis, "Ultra-Deep Thermophysical Diagnostics in Animal Bones with Fat-Skin Overlayers Using a New Pulsed Photothermal Radar", paper # 2269, 18th NIST/ASME Symposium of Thermophysical Properties, June 24-29, 2012, Boulder, CO; Monday June 25.
166. N. Tabatabaei and A. Mandelis, "Thermal Coherence Tomography Using Match Filter Binary Phase Coded Diffusion Waves: Physical Principles and Thermophysical Applications", paper # 2270, 18th NIST/ASME Symposium of Thermophysical Properties, June 24-29, 2012, Boulder, CO; Thursday June 28.
167. A. Mandelis, S. Telenkov and R. Alwi, "Signal-to-noise optimization of correlation photoacoustic (radar) imaging through optical modulation "waveform engineering" Advanced Laser Technologies ALT'12, Session PAC-MO-2C, paper # 3, Thun, Switzerland, Sept. 2 – 6, 2012.
168. A. Mandelis, "Biomedical scanning and tomographic imaging using the Photoacoustic Radar and development of Wavelength Modulated Differential Photoacoustic Spectroscopy", 41st Symposium for Research Awardees, Alexander von Humboldt Foundation, March 14 – 17, 2013, Bamberg, Germany.
169. **(Keynote Speaker)** A. Mandelis, "Thermophotonic radar and thermal coherence tomographies", Int. Symp. On Applied Electromagnetics and Mechanics, ISEM2013, Université Laval Québec, Aug. 2, 2013, Quebec, Canada
170. **(Conference Opening Ceremony Plenary Speaker)** A. Mandelis, "Photothermal Coherence Tomography", 17<sup>th</sup> International Conference on Photoacoustic and Photothermal Phenomena (ICPPP 17), October 20 - 24, 2013, Suzhou, Jiangsu, China.
171. A. Mandelis and N. Tabatabaei, "Photothermal coherence tomographies for hard tissue imaging", Paper 8926-108, SPIE BiOS Conference on Optics in Bone Surgery and Diagnostics, Feb. 1, 2014 Photonics West, San Francisco, CA, USA.
172. **(Keynote Speaker)** A. Mandelis, "Dynamic thermal-wave coherence tomographies for NDT and Biomedical Imaging", Far East Forum on Non-Destructive Evaluation/Testing (FENDT) 2014, Chengdu, China, June 20-23, 2014.



173. **(Conference Opening Ceremony Plenary Speaker)** A. Mandelis, S. A. Telenkov, and R. Alwi, “Signal-to-noise optimization of correlation photoacoustic (radar) imaging through optical modulation “waveform engineering””, ULTRASONICS 2014, 15th - 17th September 2014, Caparica, Portugal.
174. **(Conference Opening Ceremony Plenary Speaker)**, A. Mandelis, “Photothermal Coherence Tomographies – Principles and Imaging Applications”, 2nd Conference on Photoacoustic and Photothermal Theory and Applications, September 23-26, 2014, Warsaw, Poland.
175. **(Conference Opening Speaker (with R. Li Voti))**, A. Mandelis, “Facts and figures of the 3rd Mediterranean International Workshop on Photoacoustic and Photothermal Phenomena”, October 5-12, 2014, Erice, Sicily, Italy; Session on: Thermophysical Properties (October 11, 2014). Opening Session on: Foundations and Techniques (October 6, 2014).
176. A. Mandelis, “Non-contact optoelectronic diagnostics of solar cell materials and devices using photocarrier radiometry, lock-in carrierography and thermography imaging”, 3<sup>rd</sup> Mediterranean International Workshop on Photoacoustic and Photothermal Phenomena, October 5-12, 2014, Erice, Sicily, Italy; Session on: Thermophysical Properties (October 11, 2014).
177. A. Mandelis, “Photothermal Coherence Tomographies – Principles and Imaging Applications”, Killam Prize in Engineering Lecture, Univ. of Alberta, Edmonton, AB, October 23, 2014.
178. A. Mandelis, "Novel Biomedical Photoacoustic Radar Imaging: State of the science and technology", Bogazici University, Dept. of Physics, Istanbul, Turkey, August 7, 2014.
179. **(Paper was selected for Best Poster Award in Area 8: Characterization Methods)**. Qiming Sun, Alexander Melnikov, and Andreas Mandelis, “Quantitative Heterodyne Lock-in Carrierographic Imaging of Silicon Wafers and Solar Cells”, 40th IEEE Photovoltaic Specialists Conference (PVSC-40), Denver, CO, June 8-13, 2014.
180. B. Lashkari, L. Yang, J. W.Y. Tan and A. Mandelis “Photoacoustic and Ultrasound Characterization of Bone Composition”, Paper 9303-610, SPIE Photonics West, BIOS Conference "Bone surgery and ablation", 7-12 February 2015, San Francisco, CA.
181. A. Mandelis “University of Toronto and the Faculty of Applied Science and Engineering: Facts and Figures of Canada's Largest and Most Research Intensive University”, Campus-wide lecture at the University of Electronic Science and Technology of China (UESTC), Invited by Student Affairs Office, May 21, 2015, 4:30 – 6:00 pm on Qingshuihe Campus, Chengdu, China.
182. A. Mandelis, “Diffusion-Wave Diagnostic Techniques in Industrial, Applied and Biomedical Physics: They Go Where No Light Has Gone Before”, Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China (UESTC), May 22, 2015, 11:00 am – 12:00 pm.
183. A. Mandelis, “Advanced diffusion-wave and laser ultrasonic NDT and NDI technologies for industrial quality control applications”, in Special Session: NDT Research for Industry 2, NDT in Canada 2015, Marriot River Cree Resort and Casino, Edmonton, AB, June 15-17 2015, 1:30 – 2:30 pm.
184. S. Choi, A. Mandelis, X. Guo and B. Lashkari, “Wavelength-Modulated Differential Photoacoustic Spectroscopy (WM-DPAS) for Very Early Detection of Breast Cancer and StO<sub>2</sub> Quantification”, in session: Thermophysical Methods for Biomaterials and Biosystems 1, June 24, 2015; 19<sup>th</sup> Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
185. J. Silvertown (on behalf of Quantum Dental Technologies and A. Mandelis, S. Abrams), “Canary dental caries detection commercialization story”, in Celebrating the International Year of Light; Industry Day: Light-Based Technologies for Healthcare, Impact Centre, 10:15 – 10:45 Tuesday, July 21, 2015.
186. **(Conference Opening Ceremony Plenary Speaker)**, A. Mandelis, “Multi-wavelength and multi-spectral modulation strategies for highly sensitive biomedical frequency-domain photoacoustic imaging”, 18th International Conference on Photoacoustic and Photothermal Phenomena (ICPPP 18), September 6-10, 2015, Novi Sad,

Serbia; Session P1, Sept. 6.

187. **(Plenary presentation)** A. Mandelis, “Diffusion-Wave Diagnostic Techniques in Industrial, Applied and Biomedical Physics: They Go Where No Light Has Gone Before”, State University of Maringa, Brazil: University-wide presentation, October 16, 2015.
188. A. Mandelis, “Dental Thermophotonics and Biomedical Frequency-Domain Photoacoustic Radar Imaging”, Faculty of Dentistry, State University of Maringa, Brazil: October 19, 2015.
189. A. Mandelis, “Development of Advanced Techniques and Instrumentation in Non-contact Lock-in Carrierography Imaging of PV Solar Cells”, College of Physics, Optoelectronics and Energy, Soochow University, Soochow, China, May 12, 2016.
190. **(Keynote)** A. Mandelis, “Multi-wavelength and multi-spectral modulation strategies for highly sensitive cancer imaging using photoacoustic radar technologies”, BIT’s 9<sup>th</sup> Annual World Cancer Congress-2016, Shanghai, China, May 14-16, 2016.
191. **(Keynote)** A. Mandelis, E. Dovlo, B. Lashkari, S. s. S. Choi “Quantitative Wavelength-Modulated Differential and Phase-filtered Photoacoustic Radar tumor hypoxia imaging toward early (pre-malignant) cancer detection: a preclinical test on nude rats”, Ultrasonics 2016; II international conference on ultrasonic based applications, Caparica, Portugal, June 6-8, 2016.
192. **(Lecturer)** A. Mandelis, “Time & frequency domain PA instrumentation & introduction to photothermal imaging”, Biophotonics and Imaging Graduate Summer School; M. J. Leahy, Chair, National University of Ireland, Ballyvaughan, Ireland, Sept. 5 – 9, 2016.
193. A. Mandelis, E. Dovlo, B. Lashkari, S. s. S. Choi “Photoacoustic Wavelength-Modulated Differential Imaging: a novel high dynamic range modality for noninvasive diagnosis of cancer”, paper PA-1-4; 24<sup>th</sup> Int. Conf. Advanced Laser Technologies (ALT-2016), Galway, Ireland, Sept. 12 – 16, 2016.
194. **(Lecturer)** A. Mandelis, “Photothermal Coherence Tomographies: Principles and Applications in Biomedicine and Manufacturing NDE”, International Summer School, 4th Mediterranean International Workshop on Photoacoustic and Photothermal Phenomena, October 19-26, 2016, Erice, Sicily, Italy.
195. A. Mandelis, C-M. Sun , A. Melnikov, “Non-destructive, non-contact evaluation of electrical parameters of silicon solar cells using camera based high-frequency lock-in carrierography (LIC) imaging”, NDT in Canada, 2016 Conference, Burlington, ON, Nov. 15-17, 2016. Session: New or Enhanced NDT Technology I, 16 November 2016 (10:00 am).
196. **(Keynote)** A. Mandelis, “Biomedical photoacoustic radar (PAR) imaging: Principles, instrumentation and cancer imaging applications”, Collaborative Conference on Radar, December 11-15, 2016, Orlando, FL, USA
197. A. Mandelis, “Non-invasive Diffusion-Wave and Photoacoustic Diagnostic and Imaging Methodologies: They go where no light has gone before”, 1<sup>st</sup> Hellenic Canadian Academic Association of Ontario (HCAAO) Symposium, April 8, 2017, University of Toronto, Opening presentation, Session III: Science and Engineering with Applications to Health; Sandford Fleming Bldg.
198. **(Keynote Tutorial)** A. Mandelis, “Photothermal - Wave Radar and Coherence Tomographies – Principles and Applications”, 19th International Conference on Photoacoustic and Photothermal Phenomena (ICPPP19), July 16-20, 2017, Bilbao, Spain.
199. A. Mandelis (with A. Melnikov, K. Sivagurunathan, X. Guo, J. Tolev, K. Ly, and R. Lawcock), “Non-Destructive Imaging of Manufactured Green Powder Metallurgy Compact Flaws (Cracks) using Thermal-Wave Radar”, NDT in Canada 2017 Conference, Quebec City, PQ, Canada, June 6-8, 2017.
200. **(Finalist, Best Student Paper Award Competition)** L Hu, M. Liu, A. Mandelis, A. Melnikov, Q. Sun, E. H. Sargent, “Colloidal Quantum Dot Solar Cell Electrical Parameter Imaging Using Camera-based High-frequency

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- Heterodyne Lock-in Carrierography”, 44th IEEE Photovoltaic Specialists Conference (PVSC), Washington, DC, June 25 – 30, 2017, Opening presentation Area 5: Advanced Characterization Methods, 29 June 2017 (1:30 pm)
201. **(Plenary)** A. Mandelis, “Photothermal Coherence Tomography: Principles and Applications of a New Thermophysics-Based Three-Dimensional Imaging Methodology”, 21<sup>st</sup> European Conference on Thermophysical Properties (ECTP), Graz University of Technology, September 3 – 8, 2017, Graz, Austria.
  202. **(Keynote)** A. Mandelis, “Photothermal Coherence Tomography (PCT): Three-Dimensional Imaging Principles and Non-Invasive Biomedical, Dental and Engineering Materials NDI Applications”, 14<sup>th</sup> International Workshop on Advanced Infrared Technology and Applications (AITA 2017), Universite Laval, Quebec City, PQ, Canada, September 27 – 29, 2017.
  203. A. Mandelis, “Quantitative characterization of “oxide free” Si-wafer surface preparation processes by all-optical Photocarrier Radiometry (PCR) and Lock-in Carrierography (LIC)”, Semilab SDI, Tampa, FL, January 25, 2018.
  204. A. Mandelis, “Photothermal Thermophysics: techniques for the measurement of thermophysical properties of matter”, Institute for Advanced Optical Technologies – Thermophysical Properties (AOT-TP), Friedrich-Alexander Universität Erlangen, Erlangen, Germany, February 21, 2018.
  205. A. Mandelis, “Intravascular Differential Photoacoustic Radar Imaging for Early Detection of Atherosclerotic Plaques in Coronary Arteries”, 46<sup>th</sup> Symposium for Research Award Winners, Alexander von Humboldt Foundation, Bamberg, Germany, March 22 – 25, 2018.
  206. A. Mandelis, “Photothermal Thermophysics: Fundamentals, Sensors, and Thermophotonic Dynamic Imaging for Industrial and Biomedical Diagnostics”, Institute of Engineering Thermophysics, Department of Engineering Mechanics, Tsinghua University, Beijing 100084, P. R. China, May 25, 2018.
  207. **(Plenary)** A. Mandelis, “Intravascular Differential Photoacoustic Radar (IV-DPAR) for Early Detection of Atherosclerotic Plaques in Coronary Arteries: State of the Imaging Art and Waveform Engineering for Speed, Resolution and Contrast Improvements”, 3<sup>rd</sup> International Ultrasonics Conference, Caparica, Portugal, June 11 – 14, 2018.
  208. A. Mandelis, H. Huan, A. Melnikov and L. Liu, “Non-destructive and non-contacting stress-strain characterization of aerospace metallic alloys and nanocoatings using photo-thermo-mechanical radiometry (PTMR)”, 20<sup>th</sup> Symposium on Thermophysical Properties, Session: Photothermal and Photoacoustic Techniques, Boulder, CO, USA, June 24 – 29, 2018.
  209. **(Invited Tutorial Lecturer)** A. Mandelis, “Foundations and Applications of Passive and Active Infrared Thermography”, International Summer School, 5th Mediterranean International Workshop on Photoacoustic and Photothermal Phenomena, September 6-12, 2018, Erice, Sicily, Italy.
  210. **(Conference Opening Ceremony Keynote Speaker)** A. Mandelis, Q. Sun, A. Melnikov, “Optoelectronic Diffusion Waves in Semiconductors: Carrier Lifetime Chronotomography Imaging of Si Solar Cells”, 7th International Conference on Smart Materials and Sustainable Technologies, April 08-09, 2019, Mississauga, ON, Canada.
  211. **(Invited Tutorial Lecturer)** A. Mandelis, “State of the art in Cardiovascular Endoscopy Imaging of Atherosclerosis using Photoacoustic Techniques with Pulsed and Continuous-Wave Optical Excitation”, ICPPP20 International Summer School: Photothermal and Photoacoustic Techniques: Theory, Instrumentation, and Applications, July 6, 2019, Chemistry Department, Lomonosov Moscow State University, Moscow, Russia.
  211. **(Keynote)** A. Mandelis, Q. Sun, A. Melnikov, “Optoelectronic Diffusion Waves in Semiconductors: Carrier Lifetime Chronotomography Imaging of Si Solar Cells”, Plenary Session E4, July 11, 2019; 20th International Conference on Photoacoustic and Photothermal Phenomena (ICPPP20), July 7-12, 2019, Moscow, Russia.
  212. **(Keynote)** X. Guo and A. Mandelis, “Wavelength-Modulated Differential Photothermal Radiometry (WM-DPTR) biosensor and applications to in-vivo blood glucose, alcohol and cannabis detection”, Session A3: Spectroscopy I, July 8, 2019; 20th International Conference on Photoacoustic and Photothermal Phenomena (ICPPP20), July 7-

12, 2019, Moscow, Russia.

213. **(Keynote):** M. Wang, A. Mandelis, A. Melnikov, C. Wang, “Lock-in Thermography Imaging Characterization of Non-Flat Structures” Session B3: Thermography II; July 9, 2019; 20th International Conference on Photoacoustic and Photothermal Phenomena (ICPPP20), July 7-12, 2019, Moscow, Russia.
214. **(Plenary)** A. Mandelis, “Fundamentals of Carrier Diffusion Waves in Electronic Solids with Applications to Quantitative Transport Parameter Dynamic Imaging in Continuous-Band and Discrete Nanolayered Materials and Devices”, Diffusion Fundamentals VIII, September 1-5, 2019, Erlangen, Germany.

## VI-2. CONTRIBUTED PRESENTATIONS (2003 - )

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1. A. Mandelis, “Photothermal Diagnostics of Engineering Materials”, Dept. of Physics, Festkoerperspektroskopie III, Ruhr Univ. Bochum, Germany; Oct. 24, 2003.
2. A. Mandelis, “Photo-Carrier Radiometry of Semiconductors”, Dept. of Physics, Festkoerperspektroskopie III, Ruhr Univ. Bochum, Germany; Nov. 7, 2003.
3. A. Mandelis, “Laser photothermal metrologies for the semiconductor fabs”, KLA Tencor, San Jose, CA; Nov. 19, 2003.
4. A. Mandelis, “Photo-carrier Radiometry metrology for Si ion implantation monitoring”, Therma-Wave, Inc., Fremont, CA; Nov. 20, 2003.
5. A. Mandelis, “Laser-induced Diffusion-Wave Science and its Applications”, Graduate Faculty Seminar, Solid-State Physics Dept., Ruhr Univ. Bochum, Germany; January 22, 2004.
6. A. Mandelis, “Biomedical photothermal and photothermoacoustic diagnostics for cancer imaging and dental caries prevention”, Dept. of Physics, Festkoerperspektroskopie III, Ruhr Univ. Bochum, Germany; January 23, 2004.
7. A. Mandelis, “Laser-Induced Diffusion-Wave Diagnostic Technologies: Go where no light has gone before”, Physics Dept., Univ. of Cyprus, Nicosia, Cyprus; March 1, 2004.
8. A. Mandelis, “Diffusion-Wave Physics and Industrial and Biomedical Applications”, Dept. of Physics, University of Athens, Panepistimioupolis Athens, Greece; April 15, 2004.
9. A. Mandelis, “Dental Depth Profilometric Diagnosis of Pit and Fissure Caries using Frequency-Domain Infrared Photothermal Radiometry and Modulated Laser Luminescence”, Academic Center for Dental Sciences, Free University of Amsterdam, Amsterdam, the Netherlands; April 20, 2004.
10. A. Mandelis, C.H. Wang, I. Delgadillo-Holfort, M. Pawlak and J. Pelzl, “*Contactless characterization of photo-carrier recombination processes in Si using rate-window photo-carrier radiometry*”, Canadian Association of Physicists Congress, Vancouver, BC, June 5 – 8, 2005.
11. A. Mandelis and A. Matvienko, “High-Precision And High-Resolution Measurements Of Thermal Diffusivity And Infrared Emissivity Of Water-Methanol Mixtures Using A Pyroelectric Thermal Wave Resonator Cavity”, Canadian Association of Physicists Congress, Vancouver, BC, June 5 – 8, 2005.
12. A. Matvienko and A. Mandelis, “Photopyroelectric Measurements of Thermal Diffusivity of Liquid Mixtures at Low Concentrations”, 38th AIAA Thermophysics Conference, 6-9 June 2005, Toronto, Canada. Session: Thermophysics Properties and Measurements.
13. A. Matvienko and A. Mandelis, “Thermal-Wave-Cavity Thermophysical Water Pollution Sensor using the CMRD Method”, Gordon Research Conference on Photoacoustic and Photothermal Phenomena, 26 June - 1 July 2005, Trieste, Italy.

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14. A. Matvienko and A. Mandelis, "Thermal-Wave Resonator Cavity: Modeling and Applications for Water Mixtures", XXI International Congress of Theoretical and Applied Mechanics, 15-21 August 2004, Warsaw, Poland.
15. R. Jeon, A. Matvienko, A. Mandelis., S. Abrams., B. Amaechi., and G. Kulkarni, "Interproximal caries detection using frequency-domain infrared photothermal radiometry", 53<sup>rd</sup> Annual ORCA Congress, Glasgow, UK, July 2006.
16. A. Matvienko, R. Jeon, A. Mandelis S. Abrams, and G. Kulkarni, "Detection of enamel demineralization with dental photothermal radiometry: experiments and theoretical modeling", 53<sup>rd</sup> Annual ORCA Congress, Glasgow, UK, July 2006.
17. A. Matvienko, R. Jeon, A. Mandelis, S. Abrams, and G. Kulkarni, "Detection of artificial surface and subsurface dental caries mineral loss using laser photothermal radiometry. 52<sup>nd</sup> Annual ORCA Congress, Indianapolis, USA, July 2005.
18. A. Matvienko and A. Mandelis, "Ultrahigh-resolution thermal-wave sensor: applications to water-ethanol mixtures", AIChE 2005 Annual meeting, Cincinnati, USA, October 2005.
19. A. Matvienko and A. Mandelis, "Photopyroelectric measurements of thermal diffusivity of liquid mixtures at low concentrations". 38<sup>th</sup> AIAA Thermophysics Conference, Toronto, Canada, June 2005.
20. A. Mandelis, Analytical Chemistry Graduate Seminar, Dept. of Chemistry, University of Toronto, "Bioacoustophotonic Imaging of Tissues", March 30, 2006.
21. A. Mandelis, Biophotonics group research seminar series, UofT – Ryerson Univ., "Photothermoacoustic Imaging of Turbid Media", Princess Margaret Hosp., May 11, 2006.
22. A. Matvienko and A. Mandelis, "Characterization of Dental Demineralization using a Biothermophotonic Technique", Sixteenth Symposium on Thermophysical Properties, Boulder, CO, July 30 – Aug. 4, 2006.
23. A. Matvienko, R. Jeon and A. Mandelis, "Dental Photothermal Radiometry: Theoretical Analysis", APS March meeting, Paper R9 8, Denver, CO, March 5-9, 2007.
24. A. Mandelis, "Bioacoustophotonic Dept-Selective Imaging of Turbid Media and Tissues: Instrumentation and Measurements", paper 71-GniZ-252, Photonics North 2006, June 5 – 8 (2006).
25. C-H. Wang, A. Mandelis and J. A. Garcia, "Non-Contact Case Depth Monitoring of Industrial Hardened Parts Using Laser Infrared Photothermal Radiometry", 4<sup>th</sup> Int. Conf. Emerging Technologies in Non-Destructive Testing, April 2-4, 2007 (Stuttgart, Germany).
26. Y. Liu, A. Mandelis, M. Choy and C.-H. Wang, "Real-time remote temperature and thickness measurement of titanium nitride thin coatings growing on steel using laser thermorefectance optical thermometer", 14<sup>th</sup> Int. Conf. Photoacoustic& Photothermal Phenomena, Cairo, Egypt, January 6 – 9, 2007, paper 3O12.4.
27. C. Wang, A. Mandelis and Y. Liu, "Influence of beam profile on measurement sensitivity of physical properties in composite structures using photothermal techniques", 14<sup>th</sup> Int. Conf. Photoacoustic& Photothermal Phenomena, Cairo, Egypt, January 6 – 9, 2007, paper 11O3.13.
28. C. Wang and A. Mandelis, "Effective hardness case depth determination in heat treated industrial steel products using photothermal radiometry, 14<sup>th</sup> Int. Conf. Photoacoustic& Photothermal Phenomena, Cairo, Egypt, January 6 – 9, 2007, paper 13O9.1.
29. J. A. Garcia and A. Mandelis, "Non-contact case depth monitoring of industrial hardened parts using laser infrared photothermal radiometry", 14<sup>th</sup> Int. Conf. Photoacoustic& Photothermal Phenomena, Cairo, Egypt, January 6 – 9, 2007, paper 13O11.1.
30. A. Matvienko, R. J. Jeon, A. Mandelis, S. H. Abrams and B. T. Amaechi, "Photothermal Detection of Incipient Dental Caries: Experiment and Modeling", Photonics East, Sept. 9 – 12 (2007), Boston MA.

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31. A. Mandelis, A. Matvienko and S. H. Abrams, "Theoretical Analysis of Dental Demineralization using Photothermal Radiometry", (SPIE BiOS, San Jose, USA, January 2008).
32. A. Hellen, R. Jeon, S.H. Abrams, A. Mandelis, and B.T. Amaechi, "Photothermal and Modulated Luminescence Detection of Demineralized Tooth Restoration Interfaces", International Association of Dental Research (IADR) Conference, July 2-5, 2008 Paper 0529, Convention Centre, Toronto, ON, Canada.
33. A. Mandelis, C.-H. Kwan and A. Matvienko, "Dynamic photophysical processes in laser irradiated human cortical skull bone measured by means of modulated luminescence and infrared photothermal radiometry", SPIE BiOS Conf. # 7548F ("Optics in Bone Biology and Diagnostics") , Paper 7548F-148, Session 2. Jan. 23 - 28, 2010, Moscone Convention Center, San Francisco, CA.
34. S. A. Telenkov, B. Lashkari and A. Mandelis, "Photothermoacoustic imaging comparison of pulsed laser and frequency-domain (radar) modalities: signal-to-noise ratio, contrast, and resolution enhancement using nonlinear chirp modulation", BiOS (Photonics West), January 21, 2010, Paper 7564-144, Poster Session. Jan. 23 - 28, 2010, Moscone Convention Center, San Francisco, CA.
35. X. Guo, A. Mandelis, A. Matvienko, K. Sivagurunathan and B. Zinman, "Wavelength-modulated differential photothermal radiometry for non-invasive blood glucose detection", BiOS (Photonics West), January 20, 2010, Paper 7564-145, Poster Session. Jan. 23 - 28, 2010, Moscone Convention Center, San Francisco, CA.
36. N. Tabatabaei, A. Mandelis and B. T. Amaechi, "Thermophotonic lock-in imaging: A dynamic thermography technique for detecting early carious lesions in human teeth" Inaugural MIE Research Symposium, University of Toronto, April 30, 2010.
37. B. Lashkari and A. Mandelis, "The Photothermoacoustic Radar: A Novel Tissue Depth-Selective Imaging Method for Cancer Tumor Diagnosis", MIE Research Symposium, University of Toronto, April 30, 2010. **(Poster; won honorable mention for poster presentation)**.
38. N. Tabatabaei and A. Mandelis, CADIFT Lab, "Photoacoustic & diffusion-wave diagnostic instrumentation and imaging techniques", Canada Research Chairs: Thinking Ahead for a Strong Future, Nov 24-25, 2010, Metro Toronto Convention Centre, Toronto, Canada (Poster).
39. A. Mandelis, "Infrared Lock-in Carrierography (Photocarrier Radiometric Imaging) of Si Solar Cells", paper 500, 2010 CAP Congress, Toronto, ON, June 7-11.
40. N. Tabatabaei and A. Mandelis, "Thermal-wave radar: A novel subsurface imaging modality with extended depth-resolution dynamic range", paper 515, 2010 CAP Congress, Toronto, ON, June 7-11.
41. A. Mandelis and S. Telenkov, "The photothermoacoustic radar: imaging comparison of pulsed laser and frequency-domain modalities", paper 502, 2010 CAP Congress, Toronto, ON, June 7-11.
42. A. Hellen, A. Mandelis, Y. Finer and B. Amaechi, "Quantitative Examination of Demineralized and Remineralized Dental Lesions Using Photothermal Radiometry and Modulated Luminescence", paper 506, 2010 CAP Congress, Toronto, ON, June 7-11.
43. A. Mandelis, C.-H. Kwan, A. Matvienko and K. Anosov, "Modulated-Luminescence and Infrared-Photothermal-Radiometry Measured Dynamic Photophysical and Thermophysical Processes in Laser Irradiated Human Cortical Skull Bone", paper 105, 2010 CAP Congress, Toronto, ON, June 7-11.
44. R. Celorrio, E. Apiñaniz, A. Mendioroz, A. Salazar and A. Mandelis, "Improved algorithm to reconstruct the thermal conductivity depth profile in hardened steels", Paper # 032, 10<sup>th</sup> Int. Conf. on Quantitative InfraRed Thermography, July 27 – 30, 2010, Quebec City, Canada.
45. X. Guo, A. Mandelis, A. Matvienko, K. Sivagurunathan, and B. Zinman, "Wavelength-modulated differential photothermal radiometry for non-invasive blood glucose detection", Paper # 052, 10<sup>th</sup> Int. Conf. on Quantitative InfraRed Thermography, July 27 – 30, 2010, Quebec City, Canada.

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46. A. Hellen, A. Mandelis, Y. Finer and B. T. Amaechi, "Real-time monitoring of dental lesions using transmission-mode photothermal radiometry and modulated luminescence", Paper # 053, 10<sup>th</sup> Int. Conf. on Quantitative InfraRed Thermography, July 27 – 30, 2010, Quebec City, Canada.
47. B. Lashkari and A. Mandelis, "Contrast comparison between frequency- and time-domain photoacoustic imaging", Poster Paper # 072, 10<sup>th</sup> Int. Conf. on Quantitative InfraRed Thermography, July 27 – 30, 2010, Quebec City, Canada.
48. A. Mandelis and J. Tolev, "Free carrier diffusion-wave modulation of a sub-bandgap cw laser beam", Paper # 082, 10<sup>th</sup> Int. Conf. on Quantitative InfraRed Thermography, July 27 – 30, 2010, Quebec City, Canada.
49. A. Matvienko, A. Mandelis, A. Hellen, R. Jeon, S. H. Abrams and B. T. Amaechi, "Quantitative analysis of dental tissue properties using photothermal radiometry", Poster Paper # 085, 10<sup>th</sup> Int. Conf. on Quantitative InfraRed Thermography, July 27 – 30, 2010, Quebec City, Canada.
50. N. Tabatabaei, A. Mandelis, and B.T. Amaechi, "Thermophotonic lock-in imaging: An active thermography system for detecting early carious lesions in human teeth", Paper # 134, 10<sup>th</sup> Int. Conf. on Quantitative InfraRed Thermography, July 27 – 30, 2010, Quebec City, Canada.
51. S. Telenkov and A. Mandelis, "Dual-Mode Photoacoustic Phased-Array Imager for Biomedical Applications", Paper # 136, 10<sup>th</sup> Int. Conf. on Quantitative InfraRed Thermography, July 27 – 30, 2010, Quebec City, Canada.
52. A. Mandelis, C.-H. Kwan, A. Matvienko and K. Anosov, "Dynamic Photophysical and Thermophysical Processes in Laser Irradiated Human Cortical Skull Bone using Photothermal Radiometry and Modulated Luminescence", 18<sup>th</sup> Int. Conf. on Advanced Laser Technologies (ALT '10), September 11 – 16, 2010, Amsterdam, Holland.
53. A. Mandelis, A. Hellen, Y. Finer and B. Amaechi, "Quantitative evaluation of simulated human enamel caries kinetics using photothermal radiometry and modulated luminescence", Paper 7883F-129, SPIE BiOS Conf. "Optics in Bone Biology and Diagnostics", Photonics West, January 22, 2011, San Francisco, CA.
54. A. Mandelis, N. Tabatabaei and B. Amaechi, "Thermophotonic lock-in imaging of early demineralized and carious lesions in human teeth", Paper 7884-09, SPIE BiOS Conf. "Lasers in Dentistry", Photonics West, January 23, 2011, San Francisco, CA.
55. S. A. Telenkov and A. Mandelis, "Biophotoacoustic Sonar: Principles of operation, imaging and signal-to-noise analysis in time and frequency domains", Paper 7899-33, SPIE BiOS Conf. "Photons Plus Ultrasound: Imaging and Sensing 2011", Photonics West, January 24, 2011, San Francisco, CA.
56. B. Lashkari and A. Mandelis, "Photoacoustic radar imaging signal-to-noise ratio, contrast, and resolution enhancement using nonlinear chirp modulation", Ontario Photoacoustics Workshop 2010, Estates of Sunnybrook, Sunnybrook Hospital, June 2nd, 2010.
57. Alwi, R., Telenkov S., Mandelis, A., "Biophotoacoustic Radar: Study on Tissue Phantoms, Comparison to Ultrasound Imaging, and Photoacoustic Contrast Agent", MIE Research Symposium, University of Toronto, May 13, 2011 (Poster).
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## VII. BOOKS AND CHAPTERS IN BOOKS

### a) Books

1. Editor and co-author of "PHOTOACOUSTIC AND THERMAL WAVE PHENOMENA IN SEMICONDUCTORS". Published by North-Holland Publishing Co., Inc., New York, 1987, ISBN 0-444-01226-5.  
  
Editor-in-Chief of the series "PROGRESS IN PHOTOTHERMAL AND PHOTOACOUSTIC SCIENCE AND TECHNOLOGY", currently published by SPIE Press, Bellingham, WA; (26 - member International Advisory Board); 1991-present.
2. Vol. I: "*Principles and Perspectives of Photothermal and Photoacoustic Phenomena*", Published January 1992, ISBN 0-444-01641-4.
3. Vol. II: "*Non-Destructive Evaluation*", Published by PTR Prentice Hall, Englewood Cliffs, N.J., November 1993, ISBN 0-13-147430-8.
4. Vol. III: "*Life and Earth Sciences*", A. Mandelis and P. Hess, Eds., SPIE Publishing Optical Engineering Press, Bellingham, WA. February 1997, ISBN 0-8194-2450-1.
5. Vol. IV: "*Semiconductors, Electronic and Optical Materials*", A. Mandelis and P. Hess, Eds., SPIE Publishing, Optical Engineering Press, Bellingham, WA January 2000. ISBN 0-8194-3506-6
6. **(Invited Authorship):** A Mandelis and C. Christofides "PHYSICS, CHEMISTRY AND TECHNOLOGY OF SOLID-STATE GAS SENSOR DEVICES", Chem. Anal. Series Vol. **125** (J.D. Winefordner, Ed.) J. Wiley, New York, Sept. 1993, 323 + xxiii ISBN 0-4771-55885-0.
7. Guest Editor of Ferroelectrics, Vol. **165**, Numbers 1-2 (1995); Special Issue on "Photopyroelectric Spectroscopy and Detection (PPES)", Published April 1995 by Gordon and Breach Publishers, Amsterdam.

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8. Special Issue Co-Editor (with K. Michaelian), SPIE Optical Engineering "SPECIAL SECTION ON PHOTOACOUSTIC AND PHOTOTHERMAL SCIENCE AND ENGINEERING", Vol. **36** (2), February 1997.
9. A. Mandelis, "DIFFUSION-WAVE FIELDS: MATHEMATICAL METHODS AND GREEN FUNCTIONS", Springer-Verlag, New York, June 2001; 741 + xii pages 174 figs. ISBN 0-387-95149-0.
10. Edited the Proceedings of the 12<sup>th</sup> International Conference on Photoacoustic and Photothermal Phenomena, 24-27 June 2002, Toronto, ON, Canada; published in Review of Scientific Instruments Vol. **74**, Number 1, January 2003, Part II: 629 pages, 205 papers.
11. A. Mandelis (Editor and author), "Optics in Bone Biology and Diagnostics", Proc. SPIE Conf. **7166**, 15 June 2009, SPIE Society of Photo-Optical Instrumentation Engineering, ISBN 10: 0819474126.
12. A. Mandelis et al. (Editors), Proc. SPIE Society of Photo-Optical Instrumentation Engineering, "Photonic Therapeutics and Diagnostics VI", 23 – 25 Jan. 2010, San Francisco, CA, USA, Vol. **7548** (SPIE Press, April 2010).
13. A. Mandelis et al. (Editors), Proc. SPIE Society of Photo-Optical Instrumentation Engineering, "Photonic Therapeutics and Diagnostics VII", 23 – 25 Jan. 2011, San Francisco, CA, USA, Vol. **7883** (SPIE Press, February 2011).
14. A. Mandelis et al. (Editors), Proc. SPIE Society of Photo-Optical Instrumentation Engineering, "Therapeutics and Diagnostics VIII", 21-26 Jan. 2012, San Francisco, CA, USA, Vol. **8207** (SPIE Press, March 2012).
15. A. Mandelis et al. (Editors), Proc. SPIE Society of Photo-Optical Instrumentation Engineering, "Photonic Therapeutics and Diagnostics IX", 2-7 Feb. 2013, San Francisco, CA, USA, Vol. **8565** (SPIE Press, April 2013).
16. A. Mandelis et al. (Editors), Proc. SPIE Society of Photo-Optical Instrumentation Engineering, "Photonic Therapeutics and Diagnostics X", 1-6 Feb. 2014, San Francisco, CA, USA, Vol. **8926** (SPIE Press, June 2014).
17. W. M. Haynes, A. Mandelis and D. Friend, Eds. Special Special Conference Issue: Selected Papers Presented at the Tenth Asian Thermophysical Properties Conference, Jeju, Republic of Korea, September 29 – October 3, 2013.
18. A. Mandelis et al. (Editors), Proc. SPIE Society of Photo-Optical Instrumentation Engineering, "Photonic Therapeutics and Diagnostics XI", 7-12 Feb. 2015, San Francisco, CA, USA, Vol. **9303** (SPIE Press, May 2015). ISBN: 9781628413939.
19. A. Mandelis et al. (Editors), Proc. SPIE Society of Photo-Optical Instrumentation Engineering, "Photonic Therapeutics and Diagnostics XII", 10-17 Feb. 2015, San Francisco, CA, USA, Vol. **9689** (SPIE Press, May 2016). ISBN: 9781628419245

### **b) Chapters in Books**

1. A. Mandelis and J.F. Zuccon, "Experimental and Theoretical Aspects of Frequency-Domain Photopyroelectric Spectroscopy of Condensed Phases (PPES); A new and powerful spectroscopic technique", in ADVANCES IN MATERIALS CHARACTERIZATION II; Materials Science Research, Vol. 19; R.L. Snyder, R.A. Condrate, Sr., and P.F. Johnson, Eds. Plenum Press, New York, 1985: pp. 279-291.
2. A. Mandelis, "Photoacoustic Measurements of Physical Processes in CdS" in PHOTOACOUSTIC AND THERMAL WAVE PHENOMENA IN SEMICONDUCTORS; A. Mandelis, Ed., North-Holland Publ. Co., Inc., New York, 1987, Ch. 15.
3. H. Coufal and A. Mandelis, "Photopyroelectric Spectroscopy of Semiconductors", in PHOTOACOUSTIC AND

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- THERMAL WAVE PHENOMENA IN SEMICONDUCTORS; A. Mandelis, Ed., North-Holland Publ. Co., Inc. New York, 1987, Ch. 7.
4. R. Wagner and A. Mandelis, "Photothermal Deflection Spectroscopy (PDS): A Quantitative Characterization Tool of Optoelectronic Energy Conversion Processes at Semiconductor/Electrolyte Interfaces", in PHOTOACOUSTIC AND THERMAL WAVE PHENOMENA IN SEMICONDUCTORS; A. Mandelis, Ed., North-Holland Publ. Co., Inc., New York, 1987, Ch. 14.
  5. **(Invited Contribution):** A. Mandelis, "Photothermal Characterization of Electrochemical Systems", in PHOTOTHERMAL INVESTIGATIONS OF SOLIDS AND FLUIDS; J. Sell, Ed., Academic Press, Inc., Orlando, Fla., 1989, Ch. 9., pp. 269-308.
  6. **(Invited Contribution)** A. Mandelis, "Frequency-Modulated Time-Delay-Domain Photothermal Spectrometry: Principles, Instrumentation and Applications to Solids", in TOPICS IN CURRENT PHYSICS Vol. 47; P. Hess, Ed., Springer-Verlag, Heidelberg, FRG, 1990, Ch.8.
  7. M. Munidasa and A. Mandelis, "Photothermal Imaging and Microscopy" in PHOTOTHERMAL AND PHOTOACOUSTIC SCIENCE AND TECHNOLOGY, Vol. I (A. Mandelis, Ed.) pp. 300-358 (1992).
  8. **(Invited Contributions)** A. Mandelis, "Photothermal/Photoacoustic Spectroscopic Measurements of Optical Absorption Coefficients in Semiconductors", HANDBOOK OF OPTICAL CONSTANTS OF SOLIDS III; E.D. Palik, Ed., Academic Press, Inc., San Diego, CA , Vol III, pp. 59-97, (1997).
  9. **(Invited Contribution)** A. Mandelis, A. Budiman and M. Vargas, "Photothermal Deep-Level Transient Spectroscopy of Impurities and Defects in Semiconductors" in ANNEALING KINETICS OF DEFECTS IN ION-IMPLANTED SEMICONDUCTORS, Semiconductors and Semimetals, Vol. 46, (R.K. Willardson and A.C. Beer, Eds), pp. 179-211 (1997).
  10. **(Invited Contribution)** A. Matvienko and A. Mandelis, "Photopyroelectric Thermal Wave Cavity Devices – 10 years later", in "Pyroelectric Materials and Sensors, 2007", (D. Ramiens, Ed., Research Signpost, Kerala, India, 2007), ISBN81-308-0095-0 (37 pages).
  11. **(Invited Contribution)** Y. Liu and A. Mandelis, "Laser Optical and Photothermal Thermometry of Solids and Thin Films", Chap. 7, pp. 297 – 336, in *Radiometric Temperature Measurements I. Fundamentals*; Z. Zhang, B.K. Tsai and Z. Machin, Eds., Vol. 42 Elsevier / Academic Press Series: Experimental Methods in the Physical Sciences, ISBN: 978-0-12-374021-2 (2010).
  12. J. A. Garcia, A. Mandelis, S. Abrams and A. Matvienko, "Photothermal Radiometry and Modulated Luminescence: Applications to Dental Caries Detection," in "*Handbook of Biophotonics, Vol. 2: Photonics for Health Care*", Jürgen Popp, Valery V. Tuchin, Arthur Chiou, and Stefan H. Heinemann (Eds.), Wiley-VCH, December 2011, Chap. 71, pp. 1047 – 1051.
  13. C-H. Wang, A. Mandelis, J. Hu, and R. Tai, "Photoacoustic and photothermal methods and tables of thermophysical property measurements", in Experimental Thermodynamics Volume IX: Advances in Transport Properties of Fluids, M. J. Assael, A. R. H. Goodwin, V. Vesovic, and W. A. Wakeham, Eds., published by the Royal Society of Chemistry (RSC), Chap. 5.2, pp. 138 – 146 (Refs. on pages 165 – 172) (2014).

## VIII. PATENTS

1. "A Thermal Wave Sub-Surface Defect Imaging and Tomography Apparatus", *Inventors:* A. Mandelis and M. Mieszkowski. U.S. Patent Office, Washington, D.C. Patent Number: 4, 950, 897; Date: August 21, 1990.
2. "Non-Contact Method for Measuring Thermal Diffusivity of Solids", *Inventors:* A Mandelis, and M. Munidasa, U.S. Patent Office, Washington, D.C., Patent Number: 5,667,700; Date: Sept. 16, 1997.



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3. "Thermal-Wave Pyroelectric Thin-Film Hydrogen Sensor", *Inventors*: L. Dorojkine, A. Mandelis *et al.*, Russian Patent No. 2092823, October 10, 1997.
4. "Non-Contact Photothermal Method for Measuring Thermal Diffusivity and Electronic Defect", A. Mandelis, M. Muidasa and D. Wolff, Canadian Patent No. 2,126,481; Date: June 6, 2000.
5. "Non-Contact Photothermal Radiometric Metrologies and Instrumentation for Characterization of Semiconductor Wafers, Devices and Non-Electronic Materials", *Inventors*: A. Mandelis, J. Garcia, L. Nicolaidis, M. Rodriguez and S. Paoloni, (US patent, filed Mar. 2000).
6. "Method and Apparatus for Detection of Defects in Teeth", *Inventors*: A. Mandelis, S. H. Abrams, L. Nicolaidis and J. A. Garcia-Hercules; US Patent 6,584,341 B1; Date: June 24, 2003.
7. "Device and method for differential sensing of hydrogen gas using thermoabsorptance or thermoreflectance", *Inventors*: A. Mandelis, C. Wang and J. Garcia, US Patent No. 7,116,421; Date: October 3, 2006.
8. "Method of Photo-Carrier Radiometry of Semiconductors", *Inventors*: A. Mandelis, J. Batista, D. Shaughnessy, and J. Garcia, US patent 7,045,786 B2; Date: May 16, 2006.
9. "Laser Photo-Thermo-Acoustic Imaging Frequency-Swept Heterodyne Lock-in Instrumentation for Industrial and Biomedical Materials", *Inventors*: A. Mandelis, A. Vitkin, S. Telenkov and Y. Fan; US patent 7,525,661 B2, Issued: April 28, 2009.
10. "Simultaneous frequency-domain infrared photothermal radiometry (PTR) and modulated laser luminescence (LUM) apparatus for diagnostics of defects in teeth", *Inventors*: A. Mandelis, S. Abrams, J.S. Jeon, K. Kulkarni and A. Matvienko, US Provisional patent submitted June 2005.
11. "Method and Apparatus for Detection of Defects in Teeth", *Inventors*: A. Mandelis, S. H. Abrams, L. Nicolaidis, J. A. Garcia-Hercules, Canadian Patent 2,314,691, issued 2011/04/26.
12. "Non-invasive Biothermophotonic Sensor for Blood Glucose Monitoring ", *Inventors*: A. Mandelis and S. Telenkov, US patent 7,729,734 issued April 20, 2010.
13. "Non-contact method and apparatus for hardness case depth monitoring ", *Inventors*: Chin-hua Wang, Jose Garcia and Andreas Mandelis, US patent 7,712,955 B2, issued May 11, 2010.
14. "Method and Apparatus using Infrared Photothermal Radiometry (PTR) and Modulated Luminescence (LUM) for Diagnostics of Defects in Teeth", *Inventors*: A. Mandelis, S. Abrams, R. Jeon, A. Matvienko and G. Kulkarni, US Patent 8,306,608 B2 issued Nov. 6, 2012.
15. "Method and Apparatus using Infrared Photothermal Radiometry (PTR) and Modulated Luminescence (LUM) for Diagnostics of Defects in Teeth", *Inventors*: A. Mandelis, S. Abrams, R. Jeon, A. Matvienko and G. Kulkarni, PCT Patent Application # PCT/CA2006/001171 submitted May 18, 2006.
16. "Optical Thermometer for Remote Temperature and Thickness Measurements of Thin Coatings on Stationary and Rotating Heated Solid Substrates", *Inventors*: A. Mandelis, Y. Liu, M. Choy and C-H. Wang, US Provisional patent submitted June 2006.
17. "A data acquisition and management system for information acquired by an oral health diagnostic device for monitoring the oral health of humans", *Inventors*: S. Abrams and A. Mandelis, US Provisional patent submitted October 2008.
18. "Non-invasive method and apparatus for diagnostics of early osteoporotic bone loss, density variation and detection", *Inventors*: Andreas Mandelis and Stephen Abrams (US Provisional patent, filed April 2008).
19. "Method of performing wavelength modulated differential photothermal radiometry with high sensitivity", *Inventors*: Andreas Mandelis and Xinxin Guo (US Provisional patent, filed November 2009).

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20. "Method of assessing oral health risk" *Inventors:* A. Mandelis and S. Abrams, US patent 8,439,681 B2, issued May 14, 2013.
21. "Method of assessing oral health risk" *Inventors:* S. Abrams and A. Mandelis, Canadian patent 2,754,166, issued August 9, 2016.
22. "Method of performing wavelength modulated differential photothermal radiometry with high sensitivity", *Inventors:* Andreas Mandelis and Xinxin Guo, US patent 8,649,835 B2, issued February 11, 2014.
23. "Systems and Methods for Thermophotonic Dynamic Imaging", *Inventors:* Andreas Mandelis, Nima Tabatabaei and Stephen Abrams, US patent 9,584,771 Issued February 28, 2017.
24. "Systems and Methods for Frequency-Domain Photoacoustic Radar Phased-Array Imaging", *Inventors:* Andreas Mandelis, Sergey Telenkov and Bahman Lashkari (US Provisional patent 61/551,261, filed October 25, 2011).
25. "Handpiece with integrated optical system for photothermal radiometry and luminescence measurements", *Inventors:* Jin-Seok Jeon, Andreas Mandelis, Stephen Abrams, Anna Matvienko, Koneswaran Sivagurunathan, Josh Silvertown and Adam Hellen (US patent 9,506,808 B2, issued: Nov. 29, 2016) (PCT Patent Application # WO 2011/140664 A2, 17 November 2011).
26. "Handpiece with integrated optical system for photothermal radiometry and luminescence measurements", *Inventors:* Jin-Seok Jeon, Andreas Mandelis, Stephen Abrams, Anna Matvienko, Koneswaran Sivagurunathan, Josh Silvertown and Adam Hellen (Chinese patent No. ZL 2011 8 0030712.2, issued: October 19, 2016).
27. "Method of processing and displaying oral health diagnostic data", *Inventors:* Stephen Abrams, Koneswaran Sivagurunathan, Josh Silvertown, Jin-Seok Jeon and Andreas Mandelis (PCT Patent Application # WO 2011/140663 A1, 17 November 2011).
28. "Method and apparatus for performing heterodyne lock-in carrierographic imaging", *Inventors:* Andreas Mandelis and Alexander Melnikov (US Provisional patent 61/623,676, filed April 13, 2012).
29. "Systems and Methods for Frequency-Domain Photoacoustic Radar Phased-Array Imaging", *Inventors:* Andreas Mandelis, Sergey Telenkov and Bahman Lashkari, US patent 9,220,415 B2; issued Dec. 29, 2015.
30. "Method and apparatus for performing heterodyne lock-in imaging and quantitative non-contact measurements of electrical properties", *Inventors:* Andreas Mandelis and Alexander Melnikov (U.S. Patent 9,131,170, Issued September 8, 2015).
31. "System and Method for Non-invasive Photothermal Radiometric Measurement", *Inventors:* Andreas Mandelis and Sergey Telenkov (US Continuation Patent 2010/0292547 A1). Issued on Nov. 18, 2010.
32. "Method and Apparatus using Infrared Photothermal Radiometry (PTR) and Modulated Luminescence (LUM) for Diagnostics of Defects in Teeth", *Inventors:* A. Mandelis, S. Abrams, R. Jeon, A. Matvienko and G. Kulkarni, Korean patent 10-1281855 issued on August 20, 2013.
33. "Method and Apparatus using Infrared Photothermal Radiometry (PTR) and Modulated Luminescence (LUM) for Diagnostics of Defects in Teeth", *Inventors:* A. Mandelis, S. Abrams, R. Jeon, A. Matvienko and G. Kulkarni, Singapore Certificate of Grant of Patent 201005221-5 issued on February 14, 2014.
34. "Systems and Methods for Performing Truncated-Correlation Photothermal Coherence Tomography", *Inventors:* A. Mandelis and S. Kaipilavil (submitted to US patent office, October 20, 2014; patent application # 14/518,984); allowed May 17, 2017)
35. "Methods for generating multiple mismatched coded excitation signals", *Inventors:* B.Lashkari, A.Mandelis and K.

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Zhang; Allowed 5/22/2018.

36. “Methods for generating multiple mismatched coded excitation signals”, *Inventors*: B.Lashkari, A.Mandelis and K. Zhang (US patent application, submitted to US patent office, July 28, 2016; patent application # 14/979,797)

37. “Apparatus for in-vitro imaging and analysis of dental samples”, *Inventors*: J. Jeon, K. Sivagurunathan, S. Abrams, A. Mandelis, J. D. Silvertown, B. Wong, A. Hellen (US Patent 9,442,069 B2, Issued Sept. 13, 2016).

38. “Pieza de Mano con Sistema Optico Integrado para Radiometria Fototermica y Mediciones de Luminiscencia” (Handpiece with Integrated Optical System for Photothermal Radiometry and Luminescence Measurements), *Inventors*: J-S. Jeon, A. Mandelis, S. Abrams, A. Matvienko, K. Sivagurunathan, J. Silvertown, A. Helen (Mexican Patent # 334583, Issued May 3, 2011).

39. “Systems and Methods for Performing Frequency-Domain Photoacoustic Imaging”, *Inventors*: A. Mandelis, S. S. Choi, B. Lashkari, B. Courtney, S. Foster (US provisional patent application, submitted to US patent office, December 28, 2018; patent application # 62/786,040)

### IX(a). UNDERGRADUATE COURSES TAUGHT IN RECENT YEARS

Course Code	Lects. (hr/wk)	Labs (hr/wk)	Tuts. (hr/wk)	Course Title	Term Taught and Number of Students (in parentheses)
MIE233S	3		1.5	Applied Science	Spring 2002 (175), Spring 2003 (237)
MIE496Y	2	-	-	Undergraduate Thesis	Fall and Spring 2002 (25)
<i>2003-2004: Sabbatical Research Leave</i>					
MIE230H1F	3	-	1.5	Engineering Analysis	Fall 2005 (145), Fall 2006 (90/180-coordinator) Fall 2007 (86/176-coordinator)
MIE333H1F	3	-	1.5	Engineering Physics	Fall 2005 (125), Fall 2006 (133), Fall 2007 (90/180-coordinator) Spring 2009 (107 and 100 students, 2 sections) Spring 2010 (103 and 100 students, 2 sections) Spring 2014 (102 and 98 students, 2 sections) Spring 2015 (108 and 96 students, 2 sections)
MIE433H1S	3	-	-	Waves and their applications in Non-Destructive Testing and Imaging	Spring 2016 (6 students)
MIE433H1S	3	-	-	Waves and their applications in Non-Destructive Testing and Imaging	Spring 2017 (5 students)

### IX(b). GRADUATE COURSES TAUGHT IN RECENT YEARS

MIE1801S	2	-	-	Engineering Analysis III	Spring 2002 (15), Spring 2003 (7), Spring 2005 (5).
MIE1126SM	2	-	-	Diffusion-Wave Fields	Summer 2003 (5)

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MIE1357SM	2	-	-	Laser Biomedical Photoacoustics, Biothermophotonics and Imaging	Summer 2006 (4)
MIE 1127S and	2			Engineering applications of sound, electromagnetic, thermal and photonic waves	Spring 2008 (7) (Course co-developer, coordinator and Guest Lecturer)
MIE1801SM	4	-	-	Engineering Analysis III	Summer 2009 (3)
MIE1801S	2	-	-	Engineering Analysis III	Spring 2010 (4)
MIE 1127S	2			Engineering applications of sound, electromagnetic, thermal and photonic waves	Spring 2010 (6) (Course coordinator and Guest Lecturer)
MIE1801S	2			Engineering Analysis III	Spring 2014 (3 plus 3 audits)
MIE 1801S	2			Engineering Analysis III	Spring 2015 (8)
MIE 1127S	2.5			Engineering applications of sound, electromagnetic, thermal and photonic waves	Spring 2016 (7)
MIE1801	2.5			Engineering Analysis III	Spring 2017 (3)
MIE1801	2.5			Engineering Analysis III	Spring 2018 (5)
MIE1801	2.5			Engineering Analysis III	Spring 2019 (5)

**X. SUPERVISION OF HIGHLY QUALIFIED PERSONNEL**

**X(a). Graduate Students, Post-Doctoral Fellows, Research Associates and Visiting Scientists**

Name	Type of Training and Status	Years supervised/ co-supervised	Title of Project or Thesis	Present Position
(1) Dodgson, James	M. A. Sc. Thesis	1983 - 84	Correlation photoacoustic spectroscopy of solids	Engineer, Toronto Transit Commission, Toronto, ON
(2) Zuccon, John	M. A. Sc. Thesis	1983 - 85	High-frequency differential piezoelectric photothermal technique using beam position modulation	Director, Professional Affairs, Association of Professional Engineers of Ontario (APEO), Toronto, ON
(3) Siu, Edwin, K.M.	M. A. Sc. Thesis	1983 - 85	Electronic transport phenomena in n-CdS single crystals	Instrumentation scientist, Onset Electrooptics, Taipei, Taiwan R.O.C.
(4) Wagner, Robert E.	M. A. Sc. Thesis	1986 - 88	A photothermal spectroscopy study of CdS/polysulfide photoelectrochemical cells	Software Engineer, OPG Canada, Toronto, ON
(5) Leung, Kwan	M. A. Sc. Thesis	1987 - 89	Laser thermal-wave interferometry	Automotive engineer, Windsor, ON
(6) Dr. Power, Joan	Post-Doctoral Fellow	1986 - 88	Photopyroelectric multi-frequency spectrometry of solids	Associate Professor, Dept. of Chemistry, McGill University, PQ
(7) Vitkin, Alex	M. A. Sc. Thesis	1988 - 89	Laser Thermoreflectance Non-	Associate Professor, Dept.

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			destructive Evaluation of Semiconductors and High-Tc Superconductors	of Medical Biophysics, University of Toronto, ON
(8) Ward, A. A.	M. Eng. Research Project (Mature student)	1987 - 88	Laser thermoreflectance of silicon p-n junctions	Retired process engineer, Toronto, ON
(9) Dr. Boroumand-Moser Farnaz	Ph.D. Thesis (co-supervised with Dept. of Chemistry, EPFL)	1988 - 91	Photopyroelectric Fourier Transform Infrared Spectroscopy of Powders	Chemical Engineer / Research Associate at Ecole Polytechnique Federale de Lausanne (EPFL), SWITZERLAND
(10) Dr. Mieszkowski, Marek R.	Post-Doctoral Fellow	1988 - 89	Photopyroelectric scanning imaging instrumentation and measurements	President, Digital Recordings, Halifax, NS; and Adjunct Professor, Dalhousie University, NS
(11) Dr. Christofides, Constantinos	Post-Doctoral Fellow / Research Associate	1988 - 92	Photothermal Hydrogen Sensors	Rector, University of Cyprus, Nicosia, CYPRUS
(12) Zhao, Wang	Visiting Scientist	1987	Thermal-Wave Tomography	Nanjing University, Key State Lab. Modern Acoustics, Nanjing, CHINA
(13) Dr. Peralta, Samuel	Post-Doctoral Fellow	1988 - 91	Photothermal Inverse Problems (Depth Profilometry)	CEO, Qvadis (IT Company), Toronto, ON
(14) Duncan, Anne	M. A. Sc. Thesis (co-supervised with Metallurgy & Materials Science Dept., UofT)	1989 - 90	Corrosion Monitoring in Microelectronics using Photothermal Beam Deflection Techniques	Unknown
(15) Dr. Wagner, Robert E.	Ph.D. Thesis	1989 - 94	Quantitative Photomodulated Optical Reflectance of Silicon and Germanium	Software Engineer, OPG Canada, Toronto, ON
(16) Dr. Munidasa Mahendra	Post-Doctoral/Research Associate	1989 - 97	Thermal-Wave Imaging, Non-Destructive Evaluation, Sensors, Inverse Problems	Sensor Scientist, Metso Automation, Richmond Hill, ON
(17) Dr. Chen, Zhuo-hui	Post-Doctoral Fellow	1989 - 92	Non-contact laser photothermal deep-level transient spectroscopy of semiconductors	R&D Scientist, Nortel, Ottawa, ON
(18) Da Silva Alison	M.A.Sc. Thesis	1990 - 93	“Photopyroelectric Spectroscopy of Multiple Quantum Wells”	Unknown
(19) Bleiss Ronald	Visiting Industrial Research Scientist, Carl Zeiss, Germany	1992 - 94	Infrared Radiometric Deep Level Transient Spectroscopy of Semiconductors	Technical Manager, Jenoptik Technologie GmbH, Jena, GERMANY
(20) Dr. Fang, Songru	Visiting Professor, Nanjing University	1991	Theoretical studies in thermal-wave tomographic imaging	Unknown
(21) Dr. Pade Offer	Visiting Scientist, Rafael, Israel	1991 - 92	Computational aspects of thermal-wave tomography	Senior Scientist, Aerodynamic Group, Rafael, Haifa, Israel
(22) Dr. Ma, Tian-Chi	Visiting Professor, Tongji University, Director Ultrasonics Lab., Institute of Acoustics	1991 - 92	Thermal-wave inverse problem using laser photoacoustics	Tonji University, Director Ultrasonics Lab., Institute of Acoustics, CHINA
(23) Dr. Buddhudu, Srinivasa	Visiting Scholar, Univ. Tirupati, India (NSERC Award)	1992 - 93	Optical materials diagnostics using infrared laser radiometry	Faculty, Electrical and Electronic Engineering, Div. Microelectronics, Tirupati Univ., INDIA
(24) Dr. Gusev Vitalyi	NSERC International Scientific Exchange Award	1992 - 93	Nonlinear thermal-wave physics	Professor, Physics Dept., Univ. du Maine, Le Mans Laval, FRANCE

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(25) Dr. Vanniasinkam, I. Joseph	Ph. D. Thesis	1993 - 97	“Laser Photothermal Investigation of Non-Radiative Sources in Solid-State Laser Materials”	Photonics Engineering Scientist, Tycoelectronics, Santa Clara, CA, USA
(26) Komendantova (MacCormack), Elena	M. A. Sc. Thesis	1993 - 95	“Infrared Photothermal Radiometry of Aluminum”	Technical Sales Engineer, Ionsystems, Toronto, ON
(27) Nicolaidis, Lena	M. A. Sc. Thesis	1994 - 96	“Thermal-Wave Tomography”	Production Manager, Therna-Wave, Inc., Fremont, CA, USA
(28) Dr. Heimlich Michael	Ph. D. Thesis (co-supervised with Dept. of Chemistry, UofT)	1992 - 97	“Photopyroelectric Surface Plasmon Sensors”	Unknown
(29) Budiman, Arief	M. A. Sc. Thesis	1994 - 96	“Photothermal Deep Level Transient Spectroscopy”	Assistant Professor, Dept. Mechanical & Manufacturing Engineering, Univ. Alberta, Calgary, AB
(30) Pun, Larry W. H.	M. Eng. Research Project	1994 - 95	Computational studies in environmental photothermal sensors	Unknown
(31) Dr. Wagner, Robert	Post-Doctoral Fellow	1994 - 95	Laser photorefectance and thermorelectance studies of industrial Si wafers	Software Engineer, OPG Canada, Toronto, ON
(32) Dr. Othonos, Andreas	Visiting scientist, Ontario Laser and Lightwave Research Center, UofT	1993 - 94	Novel photothermal beam deflection instrumentation for in-situ laser rod ageing monitoring	Associate Professor, Dept. of Physics, Univ. of Cyprus, Nicosia, CYPRUS
(33) Dr. Shen, Jun	Post-Doctoral Fellow	1993 - 97	Thermal-wave resonant cavity: development and sensor applications	Research Officer, NRC Integrated Manufacturing Technologies Institute, Western Lab., Vancouver, BC
(34) Dr. Wolff, Detlev	Visiting Scholar, DAAG Program, Germany	1993- 94	Defect semiconductors photothermal rate-window measurements and theoretical support	Production and Procurement Manager, Jenoptik Laserdiode GmbH, Jena, GERMANY
(35) Prescott, Valton	M. Eng. Research Project	1994 - 95	“Boxcar Rate-Window Thermophysics”	Instructor, DeVry / RCC Institute, Toronto, ON
(36) Dr. Garcia Jose H.	Post-Doctoral Fellow / Research Associate	1995 - 2001	Photothermal hydrogen sensor development	Vice-President Engineering, Photo-Thermal Diagnostics, Inc., Toronto, ON
(37) Dr. Vargas-Luna, Miguel	Post-Doctoral Fellow (Recipient of Mexican Post-Doctoral Research Fellowship Award)	1995	Laser photothermal studies of transport properties of defect semiconductors	Professor, Institute of Physics, Universidad Guanajuato, Leon, MEXICO
(38) Dr. Dorodjkine, Leonid	Visiting Scientist, N. S. Kurnakov Institute, Russia; recipient of NSERC Visiting Award	1995	Thin-film hydrogen sensor development	Research Scientist, Dept. Chemistry, N. S. Kurnakov Inst., Russian Academy of Sciences, Moscow, RUSSIA
(39) Dr. Salnick, Alex	Post-Doctoral Fellow; Recipient of NSERC / NATO Award	1995 - 96	Photothermal radiometry of semiconductors	Research Scientist, Therna-Wave, Inc., Fremont, CA, USA
(40) Nestoros, Marios	M. Sc. Thesis (co-supervised with Dept. Natural Sciences, Univ. of Cyprus)	1994 - 96	Infrared laser photothermal radiometry of doped silicon	Biomedical technical officer, Nicosia General Hospital, CYPRUS

Andreas MANDELIS CV

(41) Poulli, Zena	M. Sc. Thesis (co-supervised with Dept. Natural Sciences, Univ. of Cyprus)	1995 - 96	Laser photothermal studies of ion-implanted silicon	Unknown
(42) Dr. Nicolaidis Lena	Ph. D. Thesis	1997 - 2000	“Thermal-Wave Inverse Problems: Depth Profilometry of Hardened Steels and Diffraction Tomography of Sub-surface Defects in Metals”	Production Manager, Therma-Wave, Inc., Fremont, CA, USA
(43) Dr. Wang, Chin-Hua	Ph. D. Thesis	1997 - 2000	“Laser-Induced Purely Thermal Wave Interferometry using a Novel Photopyroelectric Instrument”	Professor, Key Lab of Modern Optical Technologies of Jiangsu Province, Institute of Modern Optical Technologies, Soochow University, Suzhou, Jiangsu, 215006, China
(44) Elek, Francis	M. A. Sc. Thesis	1997 – 99	“An Investigation of Photothermal Radiometric Thermal Diffusivity Measurements of Thin Steel Samples”	Ph.D. thesis, Dept. Electrical and Computer Engineering, UofT
(45) Dr. Ikari, Tetsuo	Visiting Professor, recipient NSERC / JAPAN Society for Promotion of Science Award	1997 - 98	Photothermal spectroscopy of semiconductors	Professor, Dept. Electrical & Electronic Engineering, Miyazaki Univ., Miyazaki, JAPAN
(46) Dr. Rodriguez, Mario	Post-Doctoral Fellow (Recipient of Mexican Post-Doctoral Research Fellowship Award)	1998 - 2000	Transport phenomena in crystalline and percolative semiconductors	Professor, Fisica Aplicada y Tecnologia Avanzada, Inst. of Physics UNAM, MEXICO
(47) Dr. Pan Guang	Post-Doctoral Fellow	1997 - 1999	Thermodynamics with thermal-wave cavities	Senior Scientist, Microbridge Technologies, Montreal, QC
(48) Li Li	M. A. Sc. Thesis	1998 - 2001	Infrared Friction Instrumentation	Unknown
(49) Eccles Chris	M. Eng. Research Project	1998 - 99	“Design and Development of an Infrared Interferometry Friction Measuring Device for Space Station Applications”	Unknown
(50) Shaughnessy, Derrick	M. A. Sc. Thesis	1999 - 2001	“Carrier Density-Wave Depth Profilometric Measurements in Semiconductor Si Wafers using Laser Infrared Photothermal Radiometry”	Ph. D. student, CADIFT
(51) Dr. Rabago, Felipe	Visiting Scientist; Recipient of Mexican Research Award	2000 - 2001	Common-mode rejection demodulation technique with applications to high-resolution ion-implantation monitoring in Si wafers	Professor, Dept. of Physics, Universidad Autonoma de San Luis Potosi, San Luis Potosi, MEXICO
(52) Dr. Balderas, Abraham	Post-Doctoral Fellow, on leave from CICATA-IPN, Mexico; recipient of Mexican Post-Doctoral Research Fellowship Award	1999 - 2002	Photoacoustic and photothermal techniques and measurements of thermophysical properties of liquids and solids	Professor, Dept. Mathematics, Unidad Profesional Interdisciplinaria de Biotecnología del IPN (UPIBI – IPN), Mexico City, MEXICO
(53) Liu, Yue	M. A. Sc. Thesis	2000 - 02	“Thermal-Wave Depth Profilometry of Heat-Treated	Post-Doctoral Fellow, CADIFT

Andreas MANDELIS CV

			Steels”	
(54) Dr. Wang, Chin-hua	Post-Doctoral Fellow, NSERC PDF Award; and Post-Doctoral Fellow	2000– 01 2003 - 06	Carrier-density-wave depth profilometric imaging in electronic solids	Professor, Key Lab of Modern Optical Technologies of Jiangsu Province, Institute of Modern Optical Technologies, Soochow University, Suzhou, Jiangsu, 215006, China
(55) Dr. Baddour, Natalie	Post-Doctoral Fellow	2001 - 04	Case-depth non-destructive evaluation in hardened industrial steels	Chevening Technology Enterprise, UK
(56) Dr. Shaughnessy, Derrick	Ph. D. Thesis	2002 - 05	“Photo-Carrier Radiometry of Industrial Si Wafers”	Staff Scientist, Therma-Wave, Inc., Fremont, CA
(57) Dr. Jeon, Raymond	Research Associate	2002 - 2012	Dental Biothermophotonics – caries diagnostics using photothermal radiometry and modulated luminescence	VP Research, Quantum Dental Technologies, Toronto, ON
(58) Dr. Batista, Jerias	Post-Doctoral Fellow, on leave from Universidade Federal Maranhao Centro Tecnologico, Dept. Physics, Sao Luis, Brazil; recipient of PDF Award by Government of Brazil	2002 - 04	Photo-Carrier Radiometry of Semiconductors: experimental and computational studies	Professor, Universidade Federal Maranhao Centro Tecnologico, Dept. Physics, Sao Luis, BRAZIL
(59) Dr. Liu, Yue	Ph. D. Thesis	2002 - 05	Optical thermometer development for industrial applications	Post-Doctoral Fellow, CADIFT 2005-06
(60) Dr. Liu, Yue	Post-Doctoral Fellow	2005 – December 06	Optical thermometer development for industrial applications	Unknown
(61) Dr. Guo, Xinxin	Post-Doctoral Fellow	2001 - 02	Photothermal diagnostics of glucose in biofluids	Research Scientist, Photo-Thermal Diagnostics, Inc., Toronto, ON
(62) Xie Ming	Visiting Technologist (funded by Shanxi Province, China)	2002	Thermal-wave resonant cavity design for fluid measurements	Unknown
(63) Dr. Matvienko, Anna	Ph. D. Thesis	2003 – 06 2009 -	Ultra-high resolution fluid mixture thermophysics using a thermal-wave cavity	Post-Doctoral Fellow, CADIFT
(64) Dr. Matvienko, Anna	Post-Doctoral Fellow	2006 –	Dental caries diagnostic techniques – Photothermal radiometry and modulated luminescence	Centre for Urban Health Solutions, Li Ka Shing Knowledge Institute, St. Michael’s Hospital.
(65) Choi, Mervyn	M. Eng. Research Project	2004	Optical thermometer: applications to ultrathin thermal coatings	Unknown
(66) Spirou, Gloria	M. Sc. (co-supervised with Dept. Medical Biophysics, UofT)	2003 - 05	“Photothermoacoustic imaging of thermal lesions”	Ph.D. student, McMaster University
(67) Dr. Fan, Ying	Post-Doctoral Fellow	2002 - 04	Frequency-domain Photo-thermo-acoustic imaging instrumentation for breast cancer applications	Research Scientist, General Electric Research Labs., Albany, NY, USA



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(68) Dr. Fukuyama, Atsuhiko	Research leave (funded by Dept. of Electrical & Electronic Engineering, Miyazaki University, Miyazaki, Japan)	2003	Comparison of laser infrared photo-thermal and photo-carrier techniques for transport property measurements in Si wafers	Research Associate Professor, Dept. Electrical & Electronic Engineering, Miyazaki University, Miyazaki, JAPAN
(69) Dr. Kumar, Shailendra	Visiting scientist, on leave from Centre for Advanced Technologies, Indore, India	2002	Surface photovoltage of depletion layers in oxide semiconductors	Scientific Officer, Centre for Advanced Technologies, Indore, INDIA
(70) Dr. Li, Bincheng	Post-Doctoral Fellow	2002 - 04	Photo-Carrier Radiometry of Semiconductors and Photothermal depth profilometry of treated ceramics	Research Professor, Institute of Optics and Electronics, Dept. Thin Film Optics, Chinese Academy of Sciences, Chengdu, Sichuan, CHINA
(71) Dr. Tolev, Jordan	Research Associate	2004 - 2011	Photo-Carrier Radiometry of Ion-Implanted Si; general laboratory supervisor	Unknown
(72) Dr. Telenkov, Sergey	Post-Doctoral Fellow / Research Scientist	2004 - 2005	Frequency-Domain chirp heterodyne photo-thermo-acoustic methodology for cancerous lesion imaging in turbid tissue.	Research Scientist, Imaging Diagnostic Systems, Inc. Plantation, FL, USA.
(73) Xia Jun	M. A. Sc. Thesis	2004 - 2006	Deep-Level Thermal Spectroscopy of Semiconductors	Ph.D. student, CADIFT
(74) Girard, Sebastien	Visiting French graduate student (EU Overseas Research Award Recipient)	2004 - 2005	High-resolution photo-carrier radiometry of silicon-on-insulator (SOI) structures	
(75) Dr. Mario E. Rodriguez Garcia	Visiting Professor, Centro de Fisica Aplicada y Tecnologia Avanzada UNAM, Queretaro, Mexico	06 - 07/2005	Photo-carrier radiometry of ultra-shallow junctions in Si	
(76) Dr. Xia Jun	Ph. D.. Thesis student	2006 - 2010	“Development of deep-level photothermal spectroscopy and photo-carrier radiometry for the characterization of semi-insulating gallium arsenide”	Assistant Professor, SUNY Buffalo (2014 - )
(77) Dr. Yangdong Hu	Post-Doctoral Fellow	2006	Photothermal microfluidics	Unknown
(78) Bahman Lashkari	Ph. D. Thesis	2006 - 2011	“Photoacoustic imaging using chirp technique: Comparison with pulsed laser photoacoustics”	PDF, CADIFT
(79) Pawlak, Michal	(co-supervised Ph.D. student from Ruhr University, Bochum, Germany)	2004 - 2008	“Photothermal and photocarrier radiometry of solids”	Assistant Professor, Nicolaus Copernicus Univ. Torun, POLAND (2012 - )
(80) Leong, Keith	Ph.D. Thesis student (ECE; co-supervised)	2004-2010	“Surface Passivation of Crystalline Silicon using Amorphous Silicon”	Jan. 05 - Dec. 2011
(81) Thao Phan	(co-supervised with Prof. Kiran Kulkarni, DENT) M.D.Sc. (DENT)	Oct. 03 – Aug. 2006	Dental Diagnostics with Photothermal Radiometry and Luminescence	Practising dentist
(82) Dr. Guo, Xinxin	Research Associate	2007 -	Industrial steels case depth hardness photothermal radiometric instrumentation; Thermophotonic blood glucose	Research Associate, CADIFT

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			biosensor	
(83) Tabatabaei Nima	Ph.D. Thesis student	Sept. 2007 - Feb. 2012	“Development of frequency and phase Modulated thermal-wave methodologies for materials non-destructive evaluation and thermophotonic imaging of turbid media”	Assistant Professor, Mechanical Engn., York University, Toronto (2014 - )
(84) Dr. Jose Garcia	Part-time Research Associate	2006 - 2010	Early dental caries diagnostic instrumentation.	President, GarCan Technologies, Toronto, ON
(85) Professor Mario E. Rodriguez Garcia	Visiting Professor	2007	Studies in Photocarrier Radiometry of GaSb and Te-doped GaSb heterostructures	Professor, Universidad Nacional Autonoma Mexico, Queretaro, Mexico
(86) Garcia-Rivera Jose	Ph.D. Student (UNAM Mexico, co-supervised with Prof. Mario Rodriguez Garcia)	2006-07	Photocarrier Radiometry of Ultrathin Junctions in Silicon	
(87) Velasquez-Hernandez Roberto	Ph.D. Student (UNAM Mexico, co-supervised with Prof. Mario Rodriguez Garcia)	2006-07	Photocarrier Radiometry of Silicon-on Insulator structures	
(88) Dr. Koneswaran Sivagurunathan	Post-Doctoral Fellow	2007- 2015	Dental caries photothermal radiometric and modulated luminescence instrumentation	Software Engineer, Quantum Dental Technologies, Inc.
(89) Adam Hellen	M.Sc. Dept. of Dentistry, UofT (co-supervised)	May 2007- March 2010	“Quantitative evaluation of demineralization and remineralization of simulated enamel caries using Photothermal Radiometry and Modulated Luminescence”	Clinical Dentistry student (M.D.Sc.), Dept. of Dentistry, Univ. of Toronto
(90) Dr. Telenkov, Sergey	Research Associate	March 2008 – March 2013	Biomedical Photoacoustic and Ultrasonic Imaging: The Photoacoustic Radar	Director of Clinical Research at CVDiagnostix Kanata, Ontario, Canada
(91) Dr. Alexander Melnikov	Research Associate	October 2008-	Solar Cell Photo-Carrier Radiometry – Industrial steel hardness depth profilometry	
(92) Ms. Delia Hurtado	Visiting Graduate Student, UNAM, Mexico	June 1 – Aug. 31, 2008	Dependence of photo-carrier radiometric signals on crystalline orientation in Si wafers.	
(93) Dr. Pablo Martinez-Torres	PhD Thesis Co-supervisee, Visiting Scientist, Conacyt, CINVESTAV, Mexico	Nov. 1, 2008 – Apr. 31, 2009	Study of thermal diffusivity depth profiles of curing resins by laser photothermal radiometry and diffusion-wave inverse-problem methods	PDF, Univ. of California
(94) Jungho Kim	MASc Thesis student	May 2009 - April 2012	“in-vitro examination of secondary caries using infrared photothermal radiometry and modulated luminescence”	Biomedical device engineer, Samsung, Korea
(95) Mohamed Saleh-Lavaee	Volunteer researcher	Feb. – June 2009	Thermal-wave diagnostics of subsurface defects using complementary signal waveforms	Graduate student, UofT
(96) Rudolph Alfred Alwi	M.A.Sc. student (IBBME)	September 2009 – May 2012	“Biophotoacoustic Radar: Study of Tissue Phantoms, Tissues, Contrast Agent and Comparison to Ultrasound Imaging for Deep	Regional Clinical Engineer, EIT Winnipeg, Canada

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			Subsurface Imaging”	
(97) Ali K. Oskooei Kazemi	Ph.D. student	May 2010 - Sept. 2010	Biomedical Photothermoacoustics: multi-transducer array imaging instrumentation	Withdrawn
(98) Syed Haq	M.Eng. student	Sept. 2009-Aug. 2010	“Lock-in carrierography of solar cells”	Unknown
(99) Dr. Sreekumar Kaipilavil	Post-doctoral Fellow	April 2010 – March 2013	Photothermal and photoacoustic instrumentation and analytical methods for very early bone osteoporosis diagnostics	
(100) Wei Wang	Ph.D. student	January 2011 – Sept. 2015	“Signal Strength and SNR Enhancement Techniques for Frequency Domain Photoacoustic Radar Imaging”	
(101) Basia Halliop	Ph.D. student, ECE, University of Toronto (co-supervised with Prof. N. Kherani, ECE)	October 2011 - June 2015	Carrierographic imaging of thin amorphous film solar cells	
(102) Dr. Hadi Babaei	Post-doctoral Fellow	January-May 2011	Theoretical modeling of photocarrier radiometry of photovoltaic solar cells	Self-employed engineer
(103) Ruben Velasquez	Co-supervised visiting Ph.D. student, Universita Autonoma de Queretaro, Mexico	August – December 2010	Case-hardness depth profiles in industrial steels using the thermal-wave radar	Ph.D. student in Universita Autonoma de Queretaro, Mexico
(104) Kyle Horne	Visiting Ph.D. student, Dept. Mechanical and Aerospace Engn., Utah State University, Logan, Utah, USA	July-August 2010	Photothermal radiometric measurements of ion-irradiated ZrC	Ph.D. student Dept. Mechanical and Aerospace Engn., Utah State University
(105) Prof. Yu Zhang	Associate Professor, Dept. of Electrical Engineering and Automation, Harbin Institute of Technology, Harbin, China	March 2011 – Feb. 2012	Lock-in and heterodyne carrierographic imaging of solar cells	Associate Professor, Dept. of Electrical Engineering and Automation, Harbin Institute of Technology, Harbin, China
(106) Dr. Bahman Lashkari	Post-Doctoral Fellow	June 2011 -	Bone density photoacoustic and ultrasonic biosensors	
(107) Qiming Sun	Visiting Ph.D. student, School of Optoelectronics, University of Electronic Science and Technology (UESTC), Chengdu, China	April - Sept. 2012	Carrierographic and thermographic imaging of industrial Si solar cells	Post-doctoral Fellow, CADIPT, UofT
(108) Jing (Susan) Wang	Visiting Ph.D. student, School of Optoelectronics, University of Electronic Science and Technology (UESTC), Chengdu, China	September 2011 – September 2013	Photocarrier radiometry of quantum-dot photovoltaic solar cells	Ph.D. candidate at UESTC, Chengdu, China
(109) Prof. Guenther Hendorfer	Visiting Professor, School of Engineering and Environmental Sciences at the University of Applied Sciences, Wels, Austria	Sept. – Dec. 2011	Lock-in infrared thermography of porous industrial thermal coatings and industrial (Austrian) solar-cell lock-in carrierography	Dean of Engineering, University of Applied Sciences, Wels, Austria
(110) Mr. Gabseok S. Seo	Senior Ph.D. student, Sungkyunkwan University, Department of Energy Science, South Korea	December 3 – 17, 2011	Biomedical Photoacoustic Radar imaging instrumentation studies with a view to initiating similar research in Korea	Researcher, Sungkyunkwan University, Korea

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(111) Prof. Junyan Liu	Associate Professor, Harbin Institute of Technology, Harbin	May 2012 – May 2013	Thermographic and carrierographic imaging studies of photovoltaic solar cells	
(112) Sean Choi	MASc, IBBME, Univ. of Toronto	Sept. 2012 – February 2015	“Wavelength-Modulated Differential Photoacoustic Spectroscopy for early detection of breast cancer and hypoxia monitoring”	PhD student , CADIFT, MIE
(113) Sean Choi	Ph.D. student	June 2014 – May 2019	Wavelength-Modulated Differential Photoacoustic Imaging for coronary disease diagnosis	Queen Elisabeth Award, 2016 A.G. Bell Canada Scholarship 2017 MIE Endowed Fellowship 2017-18 Currently: Insight Data Science (an AI company) Data Processing Analyst / Fellow, Toronto
(114) Prof. Mohammad E. Khosroshahi	Professor, Amirkabir University, Tehran, Iran	July 2012 - December 2014	Contrast enhancing agents for biomedical photoacoustic imaging.	Director, Biomedical Division, MIS Electronics, Inc. Toronto
(115) Dr. Raquel Fuente Dacal	Post-doctoral Fellow, University of the Basque Country (Spain)	Sept. – December 2012	Dynamic infrared thermography for the NDT of industrial automotive components	
(116) Dr. Lifeng Yang	Visiting Post-Doctoral Fellow, School of Optoelectronics, University of Electronic Science and Technology (UESTC), Chengdu, China	February 2013 – February 2014	3-dimensional imaging of bone density using co-registered photoacoustic and ultrasound methods.	Instructor, University of Electronic Science and Technology of China (UESTC), Chengdu, China
(117) Prof. Enqi Wu	Visiting Associate Professor, University of Shanghai for Science and Technology, China	October 2013 – August 2014	Lock-in thermography of anisotropic carbon fiber solids	Professor, University of Shanghai for Science and Technology, China
(118) Professor Natalie Baddour	Visiting Associate Professor, University of Ottawa, Canada	November 2013 – April 2014	Theoretical aspects of biomedical photoacoustic imaging using the photoacoustic radar.	Professor, University of Ottawa, Canada
(119) Yingcong Zhang	International Visiting Research PhD Student, Nanjing University of Science & Technology, China	December 2013 – December 2014	Experimental and theoretical studies of amorphous Si solar cells using photocarrier radiometry	Ph.D., Nanjing University of Science & Technology, China; Instructor, Nantong Polytechnic College, China
(120) Roberto Carlos Ramirez Suaste	International visiting research student, Technological University of Queretaro, Mexico	May – September 2013	Dynamic non-destructive thermographic imaging of nanocoating flaws and/or thermophysical properties in the aerospace industry	Graduate of Technological University of Queretaro, Mexico
(121) Jessica Pitta Ledesma	International visiting research student, Technological University of Queretaro, Mexico	January 2 – May 30, 2014	Quantitative non-destructive lock-in thermographic imaging of industrial steel hardness profiles for the aerospace industry	Graduate of Technological University of Queretaro, Mexico

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(122) Edem Dovlo	Ph.D. student	Sept. 2013 – January 2017	“Co-registration of Ultrasound and Photoacoustic Radar Imaging and Image Improvement for Early Cancer Diagnosis”	Awarded the 2017 MIE Graduate Research Discovery Award for outstanding thesis and publication record; currently Faculty Member, McMaster University, ON, Canada. Asst. Professor, McMaster University
(123) Yijun Liu	M.A.Sc. student (IBBME)	Sept. 2013 – June 2015	“Development of a Noninvasive In-Vehicle Alcohol Biosensor Using Wavelength-Modulated Differential Photothermal Radiometry”	Engineer, Myticas Consulting, Ottawa
(124) Dr. Jordan Tolev	Research Associate	October 2013 – October 2015	Non-Destructive Imaging of Manufacturing Flaws in Industrial Automotive Powder Metallurgy Green and Sintered Parts using a Novel IR Thermal-Wave Radar Technology	Engineering researcher, Optical and Optoelectronic Systems, ITMO University, North York, ON, Canada
(125) Lilei Hu	Ph.D. student	Sept. 2014 – December 2017	Photocarrier radiometry and lock-in carrierography of quantum-dot photovoltaic solar cells	Research scientist, iRay Techonology, medical equipment company, Shanghai, China
(126) Pantea Tavakolian	Ph.D. student	Sept. 2014 – Dec. 2018	Functional in vivo photothermal coherence tomography of small animals	Post-doctoral Fellow, CADIPT
(127) Ronald Hoffer	M.A.Sc. student	Sept. 2014 – March 2015 (self-terminated candidacy)	Design of endoscopic photoacoustic radar and ultrasound imaging catheter for coronary fat diagnosis	
(128) Huiting Huan	Visiting Ph.D. student, UESTC, Chengdu, China	October 2014 – November 2016	Laser ultrasonic NDT of aerospace components under stress	Asst. Professor, Xidian University, China
(129) Lixian Liu	Visiting Ph.D. student, UESTC, Chengdu, China	October 2014 – November 2016	Fourier transform infrared differential photoacoustic spectroscopy of air-polluting trace contaminants	Asst. Professor, Xidian University, China
(130) Ken Tang	M. Eng. student	Sept. 2014 – March 2015	“Reliability analysis of non-destructive coating measurements using Laser infrared Photothermal Radiometry”	Mechatronics Engineer at ENGINEERING SERVICES, INC., Toronto, ON
(131) Prof. Ibrahim Serroukh	Universita Autónoma, Querétaro Mexico	Nov. 1, 2014 – Sept. 30, 2015	Heterodyne lock-in carrierography of Si solar cells	Professor, Universita Autónoma, Querétaro Mexico
(132) Simon Liang	M. Eng. student	Sept. 2015 – June 2016	“Application of Photoacoustics for Temperature-Dependent Measurement of Grüneisen Parameters”	

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(133) Diego Armando Ramirez Venegas	International visiting research student, Technological University of Queretaro, Mexico	January 4 – April 25, 2016	Quantitative non-destructive lock-in thermographic imaging of industrial coatings for the aerospace industry	
(134) Prof. Dong Yel Kang, Ph.D.	Assistant Professor School of Basic Sciences, College of Engineering, HanBat Natl Univ, Daejeon, Korea	August 1-25, 2016	Biomedical Frequency-Domain Photoacoustic signal enhancement studies	Asst. Professor, School of Basic Sciences, College of Engineering, HanBat Natl Univ, Daejeon, Korea
(135) Di Zhang	M. Eng. student	September 2016 – December 2017	Theoretical and computational simulations of wavelength modulated differential photothermal radiometry biosensor	Software engineer, Kubra, ON, Canada
(136) Claudia Edith Zavala-Lugo	International visiting research student, Technological University of Queretaro, Mexico	April – September 2017	Analysis of trap-state defects in CdZnTe bulk crystals using photocarrier radiometry and lock-in carrierography	
(137) Hussein Arwani	M. Eng. student	September 2016 – Sept. 2017	Dynamic imaging of photovoltaic structures	Randstad Canada
(138) Khashayar Shojaei-Asanjan	M. A. Sc. student	September 2016 – Sept. 2018	Wavelength-modulated differential photothermal radiometry alcohol sensor	HCFI Consulting, Toronto, CA
(139) Akshit Soral	M. Eng. student	September 2016 – December 2017	Electronic trap imaging in HgCdZnTe semiconductors using high-frequency lock-in carrierography	Mechanical engineer, Aspin, Kemp and Associates (AKA), Prince Edward Island, Canada
(140) Dr. Qiming Sun	Post-doctoral Fellow	September 2015- October 2017	Lock-in carrierography and Chrono-tomography imaging of optoelectronic structures	Associate Professor, UESTC, Chengdu, China
(141) Dr. Konesh Sivagurunathan	Research Associate	Sept. 2015 -	Software development for photothermal and themophotonic mid-infrared camera imaging	
(142) Yu Chen (Chauncey) Liu	M. Eng. student	September 2018 – March 2019	Photocarrier radiometry and lock-in carrierography of perovskite solar cells	
(143) Sohrab Roointan	M.A.Sc student	Sept. 2017 – Sept. 2019	“3D Dental Subsurface Imaging Using Enhanced Truncated-Correlation Photothermal Coherence Tomography”	Research Assistant, CADIPT
(144) Dr. Hai Zhang	PDF	Sept. 2017 – Sept. 2018	Development of software for TC-PCT imaging of small animal tumors	
(145) Mingfeng Wang	Visiting Ph.D. student	January – March 2018	Therrmal-wave theory and imaging of solids with interior corners	
(146) Wei Yu	Visiting Ph.D. student	August 2017 – August 2018	Quantitative NDI of industrial solids using single frequency thermal-wave radar	

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(147) Peng Song	Visiting Ph.D. student	Sept. 2017 – Sept. 2018	Lock-in carrierography and photocarrier radimetry of semiconductor Si wafers	
(148) Sahar Kooshki	Visiting Ph.D. student	Sept. 2017 – October 2018	Photothermal inverse problems using integral equation approach – software development	Ph.D. candidate, Yazd University, Iran
(149) Daren Zheng	Visiting Ph.D. student ; Xi’an Jiaotong University, School of Energy and Power Engineering , Oct. 1, 2018 – Sept. 30, 2019	Sept. 2018 -	Photothermal inverse problems using integral equation approach - applications	
(150) Elnaz Shokouhi	Ph.D. student	January 2019 -	TC-PCT imaging of small animal tumors	
(151) Alireza Jangloo	Ph.D. student	January 2019 -	Design and implementation of coronary artery catheter for imaging of atherosclerotic vulnerable plaques	
(152) Prof. Yaqin Song, Xian Jiaotong University, China	Professor	December 2018 -	Theory and experimental validation of defect state semiconductor Si wafers using photocarrier radiometry and lock-in carrierography	
(153) Dr. Bahman Lashkari	Research Associate	December 2018 -	Development of photoacoustic frequency-domain techniques for biomedical imaging	
(154) Dr. Kimberly Ngai (Dr. Dentistry) (co-supervised with Prof. Yoav Finer, Faculty of Dentistry)	MHSc student	2017 -	Correlation studies of photothermal coherence tomography and confocal laser scanning microscopy of dental biofilms	
(155) Robert Welch	M.A.Sc. student	Sept. 2019 -	3D Dental Bacteria Imaging Using Enhanced Truncated-Correlation Photothermal Coherence Tomography	
(156) Xianzhi Wang	Visiting Ph.D. student; Northwestern Polytechnical University (NWPU), Xi'an, China.	Sept. 2019 -	Truncated correlation photothermal coherence tomography imaging for NDI of automotive component flaws	
(157) Lishuai Liu	Visiting Ph.D. student; Electrical Engineering, Tsinghua University, China.	Sept. 2019 -	Thermal wave imaging of subsurface defects and evaluation of power systems	

**X(b). B.A.Sc. Theses, Undergraduate, High-School, New Immigrant Scientists**

Name	Type of Training / Supervision and Status	Years supervised / co-supervised	Title of Project or Thesis	Present Position
(1) Andreetta, C.	B. A. Sc. Thesis	1984 - 85	Optical sensor applications in Robotics	Unknown
(2) Branco, C. M.	B. A. Sc. Thesis	1984 - 85	Thermal-wave studies of	Unknown

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			ion-implanted Silicon wafers	
(3) Care, F.	B. A. Sc. Thesis	1984 - 85	Photopyroelectric circuit for the investigation of phase transitions in solids	Unknown
(4) Wagner, Robert E.	B. A. Sc. Thesis	1984 - 85	Photoelectrochemical studies of CdS single crystalline electrodes using the Mirage effect	Software Engineer, OPG Canada, Toronto, ON
(5) Lymer, John D.	Summer research student	1984	Thermophysical measurements of fuel cell electrodes	Unknown
(6) Macchia, Enzo	B. A. Sc. Thesis	1983 - 84	Mechanical stress effects on electronic properties of crystalline silicon	Senior Staff Engineer, Pratt & Whitney Canada, Mississauga, ON
(7) Zver, Martin, M.	UG Research Assistant	1985	Photopyroelectric Spectroscopy of Solids	Unknown
(8 - 10) Burns, James and Leung, Anna	B. A. Sc. Thesis (Joint)	1985 - 86	Thermal-wave depth profiling of inhomogeneous solids	Unknown
(11) Musing, Andreas N.	B. A. Sc. Thesis	1985 - 86	Characterization of several n-type CdS photoelectrochemical cells	Unknown
(12) Taylor, Martin	Summer research student	1985	Computer-aided theoretical investigation of optically excited solids with inhomogeneous thermal diffusivity	Unknown
(13) McKenzie, Timothy	Summer research student	1986	Photopyroelectric imager design	Unknown
(14) Verdin, Gordon	Summer research student	1986	Thermal-wave imaging of subsurface defects in engineering solids	Unknown
(15) Gowman, Linda	B. A. Sc. Thesis	1986 - 87	Laser photothermal studies of biofluids	Department of Medical Biophysics, University Hospital, University of Western Ontario, London, ON.
(16) Nguyen, T. D.	B. A. Sc. Thesis	1987 - 88	Laser studies of biomaterials	Unknown
(17 - 19) Ghandi, K., Baltman, R. Lin, M.	High-School Students (Grade 13)	1987 - 88	Faculty of Arts & Sciences Mentorship Program	Unknown
(20) Dr. Ghandi, Kamyar	UofT Engineering Science Research Assistant	1988 - 89	Photopyroelectric Spectroscopy of Amorphous Si:H Thin Films	MIT Ph.D. in Aerospace Sciences; VP, R&D Continuum Control Corp., Billerica, MA, USA
(21) Romano, John	B. A. Sc. Thesis	1989 - 90	Photopyroelectric hydrogen detectors	Unknown
(22) Ellis, Susan	B. A. Sc. Thesis	1989 - 90	Thermal properties of processed aluminum using time-delay	Unknown



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			spectrometry	
(23) Lo, Andrew	B. A. Sc. Thesis	1989 - 90	An extension of Kubelka-Munk theory in reflectance spectroscopy using perturbation analysis	Technical Manager, Schneider Electric, 8 North Dong Sanhuan, Chaoyang District, Beijing, CHINA
(24) Ferguson, C.	B. A. Sc. Thesis	1990 - 91	Thermal-Wave Tomography of Solids	Unknown
(25) Lam, K-S.S.	B. A. Sc. Thesis	1990 - 91	Laser non-destructive evaluation of ceramics	Unknown
(26) Rabadi, A.	B. A. Sc. Thesis	1990 - 91	Thermal-wave imaging of engineering materials	Unknown
(27) Gallardo, R.	B. A. Sc. Thesis	1991 - 92	Gas laser system construction	Unknown
(28) Grossman, J. P.	High-School Student (Grade 13)	1991-92	Computational aspects of Kubelka-Munk equations	Research Scientist D. E. Shaw Research - Hardware Architecture, NYC, USA
(29) Shrivastava, A.	B. A. Sc. Thesis	1991 - 92	Inversion of Laplace Transforms; applications to thermal-wave diffraction tomography	Unknown
(30-32) Ogg Cameron; Ficnar Frank; Rawski Jacob	High-School Students (Grade 13)	1991 - 92	Faculty of Arts & Sciences Mentorship Program	Unknown
(33-37) Wong Pauline Yang, Victor Carbajales, Sebastian Katz, Arrin Damczuk	High-School Students (Grade 13)	1992 - 93	Faculty of Arts & Sciences Mentorship Program	V. Yang: Ph. D. student, Dept. Medical Biophysics, UofT; A. Katz: Scientist, NIST Advanced Technology Program (Biochips), NIST MD, USA
(38-42) Chan, Howard Kuperman, Alex Luxat, David Yao, Daniel Kubelnik, Dalibor	High-School Students (Grade 13)	1993 - 94	Faculty of Arts & Sciences Mentorship Program	Unknown
(43) McAllister, Ken	UTMIE 3 <sup>rd</sup> Year summer research student	1994	Laser photothermal archaeometry of ancient stones from Cyprus	Unknown
(44) Thomas, Chris (Marc Garneau C.I.)	High-school co-op student	1993 - 94	Ti:Sapphire laser rod manufacturing studies	Unknown
(45-51) Parucha, Joseph (De la Salle College "Oaklands")	High-school co-op student	1993 - 94	Thermal-wave tomography	R&D module design engineer, JDS Uniphase Corp. Ottawa, ON
Aulicino, Anthony Correia Robert, Devalia, Devan Larsen C. Lee Ogbamichael, Tekle Sit, Shy-Yan	B. A. Sc. Theses	1994- 95	Various topics in thermal-wave science and engineering	Unknown
(52-55) Bruscia, Rita Laskarzewska, Barbara Artham, Srinivasan Jain, Lily	High-School Students (Grade 13)	1994 - 95	Faculty of Arts & Sciences Mentorship Program	Unknown

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(56) Persaud, Devindra	B. A. Sc. Thesis	1995 - 96	Thermal-wave assessment of coating adhesion	Unknown
(57) Ho, Vivien	B. A. Sc. Thesis	1996 - 97	Biomedical photoacoustics	Unknown
(58) Dummit, Stephen	B. A. Sc. Thesis	1997 - 98	Computational simulations of thermal coatings on metals using thermal-wave frequency scans	Unknown
(59-62) Leies, Nick (Humberside C. I.) Marinova, Margarita (Northern Secondary) Ting, Elmer (Brebeuf C.I.) Chen Yan (Jarvis C. I.)	High-school co-op students	1997 - 98	Various topics in diffusion-wave sciences	<i>Marinova:</i> NASA Ames Research Center, Moffett Field, CA, USA <i>Chen:</i> Engineer, Software QA, Actel Corp., Sunnyvale, CA, USA
(63-64) Lee Billy Martin, Steven C.	B. A. Sc. Theses	1999 - 2000	Various topics in diffusion-wave sciences	Unknown
(65-70) Feng, Chris (Western Technical Commercial School) Wong, Pauline (Mary Ward Catholic Secondary) Januszonis, Arvydas (Bishop Allen Academy) Nazareno, Nicholas (Markville Secondary, Markham, ON) Vicram Ralh (Missisauga Private School) Nelson, Liz (Jarvis C.I.)	High-school co-op students	1998 - 99	Various topics in diffusion-wave sciences	<i>Feng:</i> Graduate student, MIT; <i>Januszonis:</i> Graduate, EECE, UofT
(71-72) Ng, Jessica, Raghunanan Sita	High-School Students (Grade 13)	1998 - 99	Faculty of Arts & Sciences Mentorship Program	<i>Ng:</i> Undergraduate student at Queen's Univ., Kingston, ON
(73) Feng, Chris	Engineering Science research assistant; Work-study program, UofT; and NSERC USRA Award	1999 – 2000  2001	Computational problems in diffuse photon density wave physics	Graduate student, MIT
(74) Chen, Yang	Engineering Science, summer research student; and Work-study program, UofT	2000  2000 - 01	Diffusion-wave simulations in solids	Engineer, Software QA, Actel Corp., Sunnyvale, CA, USA
(75) Ziman, Robert	High-School Student (Grade 11 Gifted Program)	1999 - 2000	Faculty of Arts & Sciences Mentorship Program	Unknown
(76-77) Ip, Tony (Jarvis C. I.) Park, Peter (Woburn C.	High-school co-op students	1999 - 2000	Various topics in diffusion-wave sciences	Unknown

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I.)				
(78) Dr. Sanchez, Victor	Research Assistant (New Immigrant, Colombia)	1999 - 2003	Development of dental histology and diagnostic imaging techniques	Candidate for School of Dentistry, UofT
(79) Dr. Chiclov, Serguei	Research Assistant	2000 - 2001	Computer software development in CADIFT	Unknown
(80) Chahwan, Alain	2 <sup>nd</sup> -Year MIE Student; NSERC USRA Award	2001	Dental caries diagnostics using laser infrared photothermal radiometry	Unknown
(81-85) Lee, Richie, Moore, Jessica, Premachandran, Thadsan Wei, Dennis Wei, Guowen	High-School Students (Grade 13)	2000 - 01	Faculty of Arts & Sciences Mentorship Program	Unknown
(86-90) Chiu, Bernard, McCracken, Mike, Conor, O'Hara, Wong, Samuel, Yeung, Edmond	High-School Students (Grade 13)	2001 - 02	Faculty of Arts & Sciences Mentorship Program	Unknown
(91) Piatkowski, Nicolas	2 <sup>nd</sup> -Year MIE Student; NSERC USRA Award	2002	Photothermal imaging of industrial ceramics	4 <sup>th</sup> -Year MIE student
(921-94) Yick, Wilson (Northern Secondary) Razl, Chris (Northern Secondary)	High-school co-op students	2001 - 02	Various topics in diffusion-wave sciences	Razl: Undergraduate student, Queen's University, Kingston, ON
(95-96) Lo, William, Fung, Peter,	High-School Students (Grade 13)	2002 - 03	Faculty of Arts & Sciences Mentorship Program	Unknown
(97) Swzedowski, Thomas	2 <sup>nd</sup> -Year MIE Student; NSERC USRA Award	2003	Computer implementation of frequency-domain photo-carrier radiometry theory	Candidate, Graduate school
(98) Wang, Yvonne (Northern Secondary)	High-school co-op student	2003	Review of biomedical optoacoustics literature	Engineering Science, UofT
(99) Han, Calvin	Work-study program, UofT	2002 - 03	Dental Thermophotonics	Graduate student, UBC
(100) Pan, Chun-Po	High-School Student (Grade 12); Faculty of Arts & Sciences Mentorship Program ; Engineering Science Work – Study student	2003 – 04  2004 - 05	Software development for scientific literature data-base construction at CADIFT.  Research assistant, industrial steels hardness monitoring using photothermal radiometry	Engineering Science student, UofT
(101) Wu, Alice	2 <sup>nd</sup> -Year Engineering Science, Biomedical Option; Work-study program and summer research student;  Work-study program	2003 – 04  2004 - 05	Research Assistant, Dental caries diagnosis using laser photothermal techniques	Graduate student, Dept. of Dentistry, UofT

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(102) Lau, Christopher	B. A. Sc. Thesis	2004 - 05	Software development for technical literature documentation and retrieval	
(103) Tiedje, David	B. A. Sc. Thesis	2004 - 05	Laser diagnostics of hardness profiles in manufactured steel screws	
(104) Yu, R. Haoliang	B. A. Sc. Thesis	2004 - 05	Statistical analysis of laser radiometric data obtained by dental lasers from carious human teeth	
(105) Najafi-Ashtiani, Payam	B. A. Sc. Thesis	2004 - 05	Investigation of the physical properties of a novel optical thermometer	
(106) Bernard Lau	2 <sup>nd</sup> -Year MIE Student; NSERC USRA Award	May – August 2005	Photothermoacoustic Imaging of Soft Tissues	
(107) Alberto Esteban Gomez	B. A. Sc. Thesis	2005 - 06	Applications of lasers to noninvasive detection of caries in human teeth	
(108) Gustavo Arvisu	B. A. Sc. Thesis	2005 - 06	Quantitative dental caries diagnostics using micro-computed tomography	
(109) Ms. Diana Brahaj	New Immigrant Engineer - volunteer	2006 - 2007	Thermal-wave cavity design	Unknown
(110) Chi-Hang Kwan	2 <sup>rd</sup> Year MIE Undergraduate, Summer NSERC USRA	May – August 2006	Thermodynamic studies of gases using a thermal-wave cavity	3 <sup>rd</sup> Year student, MIE
(111) Angela Ying Jie Yao	3 <sup>rd</sup> Year Eng. Sci. Work-study program	Sept. 2005-March 2006	Dental photothermal diagnostics	4 <sup>th</sup> Year student, Eng.Sci.
(112) Lin Lin Yang	William Lyon MacKenzie C.I. Faculty of Arts & Sciences Mentorship Program	Sept. 2005 – May 2006	Thermal-Wave Cavity measurements of Liquids	
(113) Anthony Dos Santos	Michael Power St. Joseph Faculty of Arts & Sciences Mentorship Program	Sept. 2005 – May 2006	Dental experiments using laser photothermal radiometry	
(114) Adam Hellen	3 <sup>rd</sup> Year Biology student at Univ. of Western Ontario	May – August 2006	Experimental research on root caries in teeth	4 <sup>th</sup> Year student
(115) Kehui (Kelly) Yan	Grade 12 student, Jarvis C.I.	Sept. 2006 – May 2007	Computational tools for thermal-wave cavity theory	
(116) Chi-Hang Kwan	3 <sup>rd</sup> Year MIE Undergraduate, Summer NSERC USRA	May – August 2007	Photothermal radiometry of animal bones; project on osteoporosis detection	4 <sup>th</sup> Year student, MIE
(117) Alejandro Martinez	3 <sup>rd</sup> Year MIE Undergraduate, Work-Study Program	October 2006 – March 2007	Experimental research on artificial caries generation in teeth	4 <sup>th</sup> Year student, MIE

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(118) Minh Doan	Grade 12 student, Delphi Secondary Alternative School	October 2006 – May 2007	Experimental research on interproximal caries generation in teeth	
(119) Chi-Hang Kwan	B.A.Sc. Thesis	2007 - 08	Photothermal radiometry and modulated luminescence in osteoporosis detection	4 <sup>rd</sup> Year student, MIE
(120) Amy Webster	B. A. Sc. Thesis	2007 - 08	Photothermal radiometry and modulated luminescence in osteoporosis detection	Exchange student, Univ. of Bristol, UK – Univ. of Toronto
(121) Benjamin Tang	B. A. Sc. Thesis	2007 - 08	High-pressure photopyroelectric signal generation in air	
(122) Michael Forcht	B. A. Sc. Thesis	2007 - 08	Photothermoacoustic imaging of tissue phantoms	4 <sup>rd</sup> Year student, MIE
(123) Ji Ke	Work-study program	2007 - 08	High pressure thermophysics using a thermal-wave cavity	4 <sup>rd</sup> Year student, MIE
(124) Alexander Paizionis	Top 1 <sup>st</sup> Year Summer Student, Faculty of Applied Science and Engineering, Undergraduate Summer Fellowship winner	May – August 2008	Photo-carrier techniques to measure silicon resistivity in a non-contact manner	2 <sup>nd</sup> Year student, MIE
(125) Harguneet Brar	4 <sup>th</sup> Year MIE Undergraduate, Summer NSERC USRA	May – August 2008	Thermodynamics of high pressure gases using a thermal-wave cavity	4 <sup>th</sup> Year student, MIE
(126) Philip Chen	Grade 12 student volunteer	June – July 2008	Glucose biosensor characterization	UofT; Engineering Science
(127) Mauricio Curbello	High-School Student (Grade 12); Faculty of Arts & Sciences Mentorship Program	January – July 2008	Dental caries statistics through photothermal and luminescence measurements	Bishop Allen Academy, Toronto
(128) Nicole Chang	High-School Student (Grade 12); Faculty of Arts & Sciences Mentorship Program	January – May 2008	Laser inspection of dental defects	Havergal College, Toronto
(129) Jane Zhang	High-School Student (Grade 12); Faculty of Arts & Sciences Mentorship Program	January – August 2008	Hardness case depth instrument design and testing for industrial uses	Branksome Hall, Toronto
(130) Philip Chen	Engineering Science student; summer fellowship (ESROP)	May - Aug. 2009	Photocarrier Imaging of Si Solar Cells	
(131) Mark Mereshensky	B.A.Sc. Thesis	2008 - 09	Photoacoustic tomographic imaging system design (ergonomics)	
(132) Mona Amariei-Voiculescu	B.A.Sc. Thesis	2008 - 09	Photoacoustic tomographic imaging system design (hardware)	
(133) Rory Chong	B.A.Sc. Thesis	2008 - 09	Software design and data optimization of laser	DDS, MS. In 2019 he was a practicing

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			thermophotonic instrument for caries diagnosis in human teeth	orthodontist at 1 <sup>st</sup> Choice Dental in Bridgeview, IL
(134) Nadim Vira	B.A.Sc. Thesis	2008 - 09	Laser photothermoacoustic diagnostic tool design for noninvasive imaging of biological tissue (hardware)	
(135) Kavita Nayar	B.A.Sc. Thesis	2008 - 09	Laser photothermoacoustic diagnostic tool design for noninvasive imaging of biological tissue (software)	
(136) Cecilia Chen Liu	Work-study program, MIE 4 <sup>th</sup> year student	2008-09	Photopyroelectric device for high pressure and emissivity thermophysics	
(137) Nhan Nguyen	High-School Student (Grade 12); Faculty of Arts & Sciences Mentorship Program	November 2008 – May 2009	Thermal-wave steel hardness measurements (data acquisition)	Weston Collegiate Institute
(138) Kimberely Chen	High-School Student (Grade 12); Faculty of Arts & Sciences Mentorship Program	November 2008 – May 2009	Thermal-wave steel hardness measurements (data analysis)	Bishop Strachan School
(139) Michael Vecchio	High-School Student (Grade 12); Faculty of Arts & Sciences Mentorship Program	November 2008 – May 2009	Photocarrier radiometry of Si solar cells	Chaminade College School
(140) Konstantin Anosov	Work-study program, Physics 3 <sup>th</sup> year student	November 2008 – May 2009; Sept. 2009 -	Photocarrier radiometry of Si solar cells; photothermal bone diagnostics	
(141) Philip Chen	Engineering Science student; summer USRA	January – August 2010 Sept. 2010 – April 2011	Lock-in Photocarrier Imaging of Si Solar Cells – software development	
(142) Kyu Hong Kim	B.A.Sc. Thesis	Sept. 2009 – March 2010	Laser dental Thermophotonics	
(143) Oren Zeev Kraus	B.A.Sc. Thesis	Sept. 2009 – March 2010	Blood glucose diagnostic instrumentation	
(144) Tian Xing Zhu	B.A.Sc. Thesis	Sept. 2009 – March 2010	Design and testing of thermal-Wave IR emissivity sensor	
(145) Ishaan Arora	Work-study program, 3 <sup>rd</sup> year Arts & Sciences student	October 2009 – March 2010	Dental enamel erosion studies using PTR/LUM	
(146) Konstantin Anosov	Work-study program, Physics 4 <sup>th</sup> year student	October 2009 – March 2010	Photothermal measurements of chromophore decay lifetimes in human skull cortical bone	
(147) Albert Hu	Northern Secondary High-School Student	October 2009 – May 2010	Thermal-wave methods for depth resolution	

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	(Grade 11); Faculty of Arts & Sciences Mentorship Program		enhancement of photothermal radiometry applications to hardened steels	
(148) Romina Abachi	March Garneau C. I. Student (Grade 11); Faculty of Arts & Sciences Mentorship Program	October 2009 – May 2010	Electrical and optical measurements on silicon multicrystalline solar cells	
(149-150) Askar Kasbekov	Bloor C.I. Student (Grade 11); Faculty of Arts & Sciences Mentorship Program	October 2009 – May 2010	Photocarrier radiometry of quantum dot solar cells	
(151) Cun Wei (Vincent) Ye	Work-study program, MIE undergraduate, 4 <sup>th</sup> year	October 2010 – March 2011	Glucose biomonitor	
(152) Vahid Amani	Work-study program, MIE undergraduate, 3 <sup>rd</sup> year	October 2010 – March 2011	Solar-cell lock-in carrierography imaging	
(153) Dora Chu	Work-study program, UofT Biochemistry undergraduate, 2 <sup>nd</sup> year	October 2010 – March 2011	Dental thermophotonic imaging	
(154) Isaac Lam	B.A.Sc. Thesis	Sept. 2010 – March 2011	Bone osteoporosis diagnostic instrumentation testing	M.A.Sc student, UBC Chemical and Biological Department
(155) Marc Pilon	B.A.Sc. Thesis	Sept. 2010 – March 2011	Analysis of dental clinical trial data using the Canary System	
(156) Romina Abachi	March Garneau C. I. Student (Grade 12); Co-op program	January – May 2011	Design and implementation of an emissivity apparatus for surface chemistry studies	
(157) Andres-Salgado Bierman	UofT Schools (Grade 12); Arts & Sciences Mentorship Program	January 2011- May 2011	Background information collection on Cu and CuO emissivity	
(158) Page Franzoi	De la Salle College “Oaklands” (Grade 11); Arts & Sciences Mentorship Program	January 2011- May 2011	Reaction chamber design for emissivity apparatus for surface chemistry	
(159) Chen Ma	4th Year MIE student research assistant	May – August 2011	Thermophotonic radar data acquisition from ex-vivo animals for trabecular bone density measurements	
(160) Yerusha Nuh	1st Year Computer Engineering, research assistant	May – July 2011	Data acquisition and analysis from industrial Si solar cells using the photocarrier radiometry	
(161) Romina Abachi	1 <sup>st</sup> Year Arts and Sciences student, UofT; 2011 winner of the Luke Santi Memorial Award for Student Achievement presented by the prestigious Perimeter Institute.	June 1 – August 30, 2012	Emissivity studies of metal surfaces using PTR	

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(162) Fadime Bekmambetova	Bloor Collegiate Institute (Grade 12); Arts & Sciences Mentorship Program	October 2011 – May 2012	Photoacoustic and ultrasonic signal propagation in bone tissue	
(163) Jenny Nguyen	Michael Power/ St. Joseph School (Grade 11); Arts & Sciences Mentorship Program	October 2011 – June 2012	Correlation between carrierographic images and the electrical parameters of silicon solar cells	
(164) Martin Deng	Marc Garneau C.I. (Grade 11); Arts & Sciences Mentorship Program	October 2011 – July 2012	Emissivity studies of metal surfaces using PTR (with R. Abachi)	
(165) Billy (Jingcong) Chen	Work-study program, UofT MIE undergraduate, 4th year	October 2011 – March 2012	Dental thermophotonic imaging and manual production of our MIR camera lock-in thermography system	
(166) Hans Zhang	Work-study program, UofT, Materials science engineering undergraduate, 3 <sup>rd</sup> year	October 2011 – March 2012	Photoacoustic signal propagation in bone tissue	
(167) Fadime Bekmambetova	1 <sup>st</sup> Year Engineering Science student; summer USRA	May 2013 – August 2013	Non-Destructive Imaging of Manufacturing Flaws in Industrial Automotive Powder Metallurgy Green and Sintered Parts	
(168) Joel Tan	2 <sup>nd</sup> Year Engineering Science student; summer USRA	May 2013 – August 2013	Photoacoustic and ultrasonic radar imaging of early bone density variations	
(169) Weiguang Ni	4 <sup>th</sup> Year MIE student; B.A.Sc. thesis research project	September 2013 – March 2014	“Dynamic Imaging of Solar Cell Optoelectronic Quality Control using a Near-Infrared Camera”	MIE graduate
(170) Yidan Xie	4 <sup>th</sup> Year Engineering Science student; B.A.Sc. thesis research project	September 2013 – March 2014	“Laser Photoacoustic Diagnostics for Bone Osteoporosis”	Eng. Sci. graduate
(171) Sarah Fondyga	4 <sup>th</sup> Year MIE Capstone Project	September 2013 – March 2014	“Integrating Photoacoustics and Tensile Testing”	MIE graduate
(172) Ginhette Reyes	4 <sup>th</sup> Year MIE Capstone Project	September 2013 – March 2014	“Integrating Photoacoustics and Tensile Testing”	MIE graduate
(173) Jong (Jeffery) Park	4 <sup>th</sup> Year MIE Capstone Project	September 2013 – March 2014	“Integrating Photoacoustics and Tensile Testing”	MIE graduate
(174) Paul Zhang	1st Year MIE student	May 2014 – August 2014	Ultrasonic and photoacoustic probing of bone density	2 <sup>nd</sup> Year MIE student (2014-15).
(175) Shendu Ma	3 <sup>rd</sup> Year MIE student; summer research award winner (IBBME)	May 2014 – August 2014	Lock-in Thermography of Manufacturing Flaws in Industrial Automotive	4 <sup>th</sup> Year MIE student (2014-15)



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			Powder Metallurgy Green and Sintered Parts	
(176) Kaicheng (Ken) Zhang	3 <sup>rd</sup> Year MIE student; B.A.Sc. thesis research project	Sept. 2014 – March 2015	“Photoacoustic Imaging and Tomography Reconstruction, Back-Projection and Compressed Sensing”	
(177) Joel Tan	4 <sup>th</sup> Year Engineering Science student; B.A.Sc. thesis research project	Sept. 2014 – March 2015	“Development of photoacoustic radar imaging for endoscopy (coronary artery) diagnosis”	
(178) Shendu Ma	4 <sup>th</sup> Year MIE student; B.A.Sc. thesis research project	Sept. 2014 – March 2015	“Validation of the Application of Backscattered Ultrasound and Photoacoustic Signals for Assessment of Bone Collagen Contents Using Hydroxyproline Assay”	Graduate student, University of Michigan
(179) Ryan Lausch	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2014 – March 2015	“Laser ultrasonic non-destructive technology for tensile testing of aerospace materials”	
(180) Oliver Nham	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2014 – March 2015	“Laser ultrasonic non-destructive technology for tensile testing of aerospace materials”	
(181) Hyung Bo Sim (Brian)	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2014 – March 2015	“Laser ultrasonic non-destructive technology for tensile testing of aerospace materials”	
(182) Atigun Treakutpan	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2014 – March 2015	“Laser ultrasonic non-destructive technology for tensile testing of aerospace materials”	
(183) Lin Sen Mu	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2015 – March 2016	Study of stresses in aerospace components using laser ultrasound (photoacoustics).	
(184) Qiwen Cao	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2015 – March 2016	Study of stresses in aerospace components using laser ultrasound (photoacoustics).	
(185) Lide Tian	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2015 – March 2016	Study of stresses in aerospace components using laser ultrasound (photoacoustics).	Graduate student, Imperial College, London, UK (2016)
(186) Feng Chang	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2015 – March 2016	Study of stresses in aerospace components using laser ultrasound (photoacoustics).	
(187) Michael McDowall	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2015 – March 2016	Design of a pre-factory level thermal-wave radar system for inspecting flaws in green	

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			automotive components	
(188) Patrick Jones	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2015 – March 2016	Design of a pre-factory level thermal-wave radar system for inspecting flaws in green automotive components	
(189) Joshua Palumbo	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2015 – March 2016	Design of a pre-factory level thermal-wave radar system for inspecting flaws in green automotive components	
(190) Patrick Luzny	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2015 – March 2016	Design of a pre-factory level thermal-wave radar system for inspecting flaws in green automotive components	
(191) Lakshmish Seewooruttun	4 <sup>th</sup> Year MIE student; B.A.Sc. thesis research project	Sept. 2015 – March 2016	Development of Photoacoustic Radar Imaging for Endoscopy	
(192) Saheb Dhody	4 <sup>th</sup> Year MIE student: Summer 2015 research project	May – August 2015	Wavelength-modulated photoacoustic imaging of coronary atherosclerotic plaque	
(193) Di Zhang	4 <sup>th</sup> Year MIE student: Summer 2016 research project	May – August 2016	Theoretical simulations of wavelength-modulated differential photothermal radiometry alcohol sensor	M. Eng. Student, MIE, UofT
(194) Karan Shukla	4 <sup>th</sup> Year MIE student: B.A.Sc thesis research project	January – March 2017	Non-contact Estimation of Si Wafer Resistivity using camera-based Photocarrier Radiometry	
(195) Yutong Zhang	4 <sup>th</sup> Year IBBME student: BME499Y Term 1 project: Applied Research in Biomedical Engineering	Sept. – December 2016	Biomedical imaging of pig coronary arteries using Wavelength-Modulated Differential Photoacoustics	
(196) Rhoda Gnanasegaram	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2018 – March 2019	Intravascular catheter design for wavelength-modulated differential photoacoustic imaging	
(197) Annie Yu	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2018 – March 2019	Intravascular catheter design for wavelength-modulated differential photoacoustic imaging	
(198) Raymond Lam	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2018 – March 2019	Intravascular catheter design for wavelength-modulated differential photoacoustic imaging	
(199) James Liu	4 <sup>th</sup> Year MIE Capstone Project	Sept. 2018 – March 2019	Intravascular catheter design for wavelength-modulated differential photoacoustic imaging	

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(200) Mohammad Ishaq Khan	4 <sup>th</sup> Year MIE student; B.A.Sc. thesis research project	Sept. 2018 – March 2019	Investigation into the influence of surface treatment and environmental conditions on the surface recombination velocity (SRV) and the epi-layer/substrate interface of silicon wafers using Photocarrier Radiometry/ Heterodyne Lock-In Carrierography
(201) Robert Welch	4 <sup>th</sup> Year MIE student; B.A.Sc. thesis research project	Sept. 2018 – March 2019	Thermophotonic dynamic imaging of human teeth for non-invasive detection of caries
(202) Stella Emiri	4 <sup>th</sup> Year IBBME student: BME499Y Term 2 project: Applied Research in Biomedical Engineering	January – March 2019	Truncated-correlation photoacoustic coherence tomography
203) Rundong Zhou	4 <sup>th</sup> Year Engineering Science student: BASc thesis project	October 2018 – March 2019	Designing the MATHUSLA Detector to search for Long-Lived Particles at CERN's Large Hadron Collider
204) Yue (Demi) Niu	4 <sup>th</sup> Year MIE student; B.A.Sc. thesis research project	September 2019 – March 2020	Dental enamel bacterial caries imaging using TC-PCT
205) Zhihuan (Scarlett) Zhou	4 <sup>th</sup> Year MIE student; B.A.Sc. thesis research project	September 2019 – March 2020	Small-animal thermophotonic imaging

**XI. RESEARCH SUPPORT**

<b>Name(s) of Grant/Contract Holder(s)</b>	<b>Support Type, Title of Proposal and Funding Source</b>	<b>Amount (or Amount/Year) \$</b>	<b>Years of Tenure</b>
Mandelis Andreas	Operating Grant, NSERC	10,000	1982 - 83
Mandelis Andreas	Pure & Applied Sciences Small Grants Competition	1,000	1982
Mandelis Andreas	Research Grant, Atkinson Charitable Foundation	14,884	1982 - 83
Mandelis Andreas	Research Grant, J. P. Bickell Foundation	21,312	1982
Mandelis Andreas	Operating Grant, NSERC	20,800	1983 - 86
Mandelis Andreas (with Mitel Semiconductors)	University/Industry NSERC	91,890	1985 - 86
Mandelis Andreas	Operating Grant, NSERC	23,100	1986 - 87
Mandelis Andreas	Equipment Grant, NSERC	54,721	1985 - 86
Mandelis Andreas	Operating Grant, NSERC	23,100	1986 - 89
Mandelis Andreas	“R&D of a fast, sensitive pyroelectric sensor for trace H <sub>2</sub> gas detection”, Energy, Mines and Resources	37,100	1986 - 88

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	Canada (EMR), Contract		
Mandelis Andreas	“Opto-Thermal NDE of Materials”, Ontario Laser and Lightwave Research Centre (OLLRC), Ontario Centres of Excellence Program; Contract	267,350	1988 - 91
Mandelis Andreas	“Opto-Thermal NDE of Materials”, OLLRC, Ontario Centres of Excellence Contract (additional equipment)	126,000	01/ 88 – 03/ 88
Mandelis Andreas (PI) and Stephen Thorpe, MMS Dept., UofT	Corrosion in Microelectronics	42,000	1988 - 89
Mandelis Andreas	International Collaborative Grant, NSERC	6,530	1988 - 89
Mandelis Andreas	Operating Grant, NSERC	26,000	1989 - 92
Mandelis Andreas	“R&D of a fast, sensitive pyroelectric sensor for trace H <sub>2</sub> gas detection – Phases III - IV”, Energy, Mines and Resources Canada (EMR), Contract	35,000	1989 - 91
Mandelis Andreas	“Photomodulation Spectroscopy of Optoelectronic Structures”, OLLRC, Ontario Centres of Excellence Contract	50,000	1992
Mandelis Andreas	Individual Strategic Grant, NSERC	69,830 (avg/yr)	1991 - 94
Mandelis Andreas	“R&D of a fast, sensitive pyroelectric sensor for trace H <sub>2</sub> gas detection – Phase V”, Energy, Mines and Resources Canada (EMR), Contract	40,000	1991 - 92
Mandelis Andreas	“R&D of a fast, sensitive pyroelectric sensor for trace H <sub>2</sub> gas detection – Phase VI”, Energy, Mines and Resources Canada (EMR), Contract	38,000	04/ 1992 – 03/ 94
Mandelis Andreas	“Nuclear Tube NDE”, Ontario Hydro, Contract	15,000	09/ 91 – 08/ 1992
Mandelis Andreas	Research Grant, NSERC	26,000	1992 - 95
Mandelis Andreas (with Ontario Hydro)	“Photo-thermal Non-Destructive Evaluation of Nuclear Materials”, Manufacturing Research Corporation of Ontario (MRCO), Enabling Contract	106,000	01/ 1993 – 12/ 94
Mandelis Andreas	“Nuclear Tube Photothermal NDE”, Ontario Hydro Contract	9,000	09/ 92 – 08/ 94
Mandelis Andreas	“Thermophysical property measurements of Zr-Nb alloys; Phase I”, Ontario Hydro Contract	1,000	09/ 92
Mandelis Andreas (for Professor Vitalyi Gusev)	International Scientific Exchange Award, NSERC	12,500	08/ 1992 – 02/ 93
Mandelis Andreas	Research Grant, NSERC	32,400	1995 - 99
Mandelis Andreas	“Boxcar Integrator”, Equipment grant, NSERC	23,400	1995 - 96
Mandelis Andreas (PI) and Harry Ruda, MMS dept., UofT	“Photothermal Radiometry of Microelectronic Structures”, Collaborative Grant, NSERC	101,000 106,318 91,500	1994 – 95 1995 – 96 1996 - 97
Mandelis Andreas (for Dr. Leonid Dorojkine)	Foreign Researcher Award, NSERC	12,900	1994 – 95
Mandelis Andreas (for Dr. Alexei Salmick)	Science Fellowship NSERC / NATO	29,000 29,000	1995 – 96 1996 - 97
Mandelis Andreas (with Ontario Hydro)	“Photo-thermal Non-Destructive Evaluation of Materials”, Enabling Contract, MRCO	125,000 (avg/yr)	01/ 1995 – 12/ 97
Mandelis Andreas	“R&D of a fast, sensitive pyroelectric sensor for trace H <sub>2</sub> gas detection – Phase VII”, Energy, Mines and Resources Canada (EMR), Contract	38,000	04/ 1994 – 03/ 96
Mandelis Andreas	“Development of thermal-wave cavity gasoline sensor”, Research Grant, Imperial Oil	10,000	1994 - 96
Mandelis Andreas (with Imperial Oil, Sarnia, ON)	“Thermal-wave gasoline sensor technology”, Collaborative Contract, MRCO	20,000	01/ 97 – 12/ 97
Mandelis Andreas	“Development of thermal-wave cavity gasoline sensor. Phase II”, Research Grant, Imperial Oil	10,000	1997
Mandelis Andreas, Tom Coyle	“Rapid Manufacturing”, Enabling Contract, MRCO	70,000 (10,000:	04/ 96 – 12/ 97

Andreas MANDELIS CV

(MMS; PI), and Chul Park (MIE)		A.M.'s portion)	
Mandelis Andreas (with B&W Heat Treating, Kitchener, ON; and Four-Cell Consulting, Toronto, ON)	“Thermal-Wave R&D for Spray Coatings, Steels and Dental Biothermophotonics”, Enabling Contract, Materials and Manufacturing Ontario (MMO)	150,000	01/ 1998 – 09/ 2001
Mandelis Andreas (PI) and Harry Ruda, MMS (with Mitel Semiconductors, Nepean, ON, and Bromont, QC)	“Photothermal Diagnostics for Electronic Materials”, Enabling Contract, MMO	150,000	04/ 1998 – 03/ 2001
Mandelis Andreas (PI) and Rod Tennyson (UTIAS) (with Spar Aerospace)	“Friction monitoring instrumentation for robotic manipulations at the International Space Station”, Research Partnership Support Program, NSERC / CSA	100,000 107,500	1998 – 99 1999 - 2000
Mandelis Andreas (PI) and Rod Tennyson (UTIAS)	“Friction monitoring instrumentation for robotic manipulations at the International Space Station” Research Contract, Spar Aerospace, Toronto, ON	57,500 57,500	1998 – 99 1999 - 2000
Mandelis Andreas	Research Grant, NSERC	35,175	1999 - 2003
Mandelis Andreas (PI) and Harry Ruda, MMS (with Mitel Semiconductors, Nepean, ON, and Bromont, QC)	Non-Destructive Laser Photothermal Metrologies for Metal, Dental Health & Semiconductor Industries”, Enabling Contract, MMO	225,000	04/ 01 – 03 / 02
Mandelis Andreas (with ATS Spartec, Burlington, ON)	“Infrared Radiometric Investigation of Aspro <sup>TM</sup> -Treated Alumina Ceramics”, Interact Contract, MMO	14,495	2001
Mandelis, Andreas	“Laser Photothermal Detection of Glucose in Tissue-Simulating Phantoms”, Contract, Aris Med, CA, USA	77,000	2001
Mandelis, Andreas (with Sputtek, Inc., Etobicoke, ON)	“Laser Thermoreflectance Temperature Measurements of Coated Ti Alloys”, Interact Contract, MMO	16,002	2001
Mandelis, Andreas (with Sputtek, Inc., Etobicoke, ON)	“Modulated Laser Thermoreflectance (Optical Thermometer) Instrumentation Development for In-Process Remote Temperature Measurements of Thin-Film Deposition”, Collaborative Contract, MMO	73,170	03/ 02 – 02/ 04
Mandelis, Andreas	“Solid-state laser”, Equipment Grant, NSERC	149,680	2002
Mandelis Andreas	Non-Destructive Laser Photothermal Metrologies for Metal, Dental Health & Semiconductor Industries”, Enabling Contract, MMO	168,750	04/ 02 – 12/ 02
Mandelis Andreas (PI) and Alex Vitkin (MBP, UofT)	“Development of a Two-Stage Biomedical Frequency-Domain Photothermoacoustic Methodology for Depth Profilometric Imaging in Turbid Media”, CHRP Grant, NSERC	142,254 112,400 91,400	04/ 02 – 03/ 03 04/ 03 – 03/ 04 04/ 04 – 03/ 05
Mandelis Andreas	“Development of CarrierDensity-Wave Infrared Radiometric Inteferometry and Near-Field Scanning Imaging for Non-Contact Semiconductor Diagnostics”, Discovery Grant, NSERC	42,500	04/ 03 – 03/ 08
Mandelis Andreas (PI) and Kiran Kulkarni (DENT, UofT) (with Four Cell Consulting, Toronto, ON)	“The Development of Laser Radiometric and Luminescence Instrumentation for the Diagnosis and Assessment of Dental Caries”, Collaborative Contract, MMO	94,787	07/ 03 – 06/ 04
Mandelis Andreas	Alexander von Humboldt Research Award	101,875 (62,500 EU)	09/ 03 – 04/ 04
Mandelis Andreas (with Photo-Thermal Diagnostics, Inc., Toronto, ON)	“Development of a Non-Contact Infrared Photo-Carrier Radiometry for Si Wafer Process Control”, Collaborative Contract, MMO	80,000	10/ 03 – 09/ 05
Mandelis Andreas (with Metex Heat Treating, Etobicoke, ON)	“Non-contact hardness and case-depth monitoring in industrial steels using laser infrared photothermal radiometry”, Collaborative Contract, MMO	196,794	10/ 03 – 09/ 06
Mandelis Andreas (PI) and	“Detection of Interproximal Lesions using Frequency-	91,984	07/ 04 – 06/ 05

Andreas MANDELIS CV

Gajanan (Kiran) Kulkarni (DENT, UofT) (with Four Cell Consulting, Toronto, ON)	Domain Photothermal Radiometry and ac Luminescence”, Collaborative Contract, MMO		
Mandelis Andreas	« Instrumentation for non-contact non-destructive low-injection imaging of heavy-ion contaminated Si wafers and silicon-on-insulator nanolayer metrology using photo-carrier radiometry” , NSERC RTI	119,639	04/06 – 03/07
Mandelis Andreas	“Optical Thermometer” Ontario Centers of Excellence OCE Market Readiness	76,410 53,850	2005 2006
Mandelis Andreas	“Crack monitoring in Stackpole green and sintered sprockets by non-destructive laser photo-thermal radiometry (PTR)”, OCE Interact Project	26,000	02/06 – 06/06
Mandelis Andreas	“Pre-Clinical Interproximal and Occlusal Caries Detection Prototype using Dental Photothermal Radiometry and Modulated Luminescence”, OCE Market Readiness	91,349	04/06 – 03/07
Mandelis Andreas	“A Prototype Instrument for Non-Contact Hardness and Case-Depth Inspection of Industrial Steels using Laser infrared Photothermal Radiometry”, OCE Market Readiness Project # CM00060 (with Metex Heat Treating Ltd.)	111,555	OCE Approved April 2007 May 07 – April 08
Mandelis Andreas (PI) and 7 others	Facility for Advanced Bioacoustophotonics and Biomolecular Microfluidic Photoacoustics CFI / ORF (NIF)	1,682,421 A.M. portion: 78.5 % Collaborative portion: 21.5%	Sept. 2007 – August 2012
Mandelis Andreas	“Pre-Clinical Interproximal and Occlusal Caries Detection Prototype using Dental Photothermal Radiometry and Modulated Luminescence”, OCE Market Readiness – Phase II	55,466	10/06 – 03/07
Mandelis Andreas (PI) and Abrams Stephen	“Industrial Development of an Early Caries Detection Prototype using Dental Photothermal Radiometry and Modulated Luminescence”, OCE Industrial Market Readiness Project awarded to Quantum Dental Technologies, Inc. , Toronto, ON.	86,800	04/07 – 09/07
Mandelis Andreas	“Crack monitoring in Stackpole green sprockets by non-destructive laser Photo-Thermal Radiometry (PTR)”, OCE Collaborative Project # CM00069 (with Stackpole Ltd.)	29,908	May 1, 07 – Sept. 31, 07
Mandelis Andreas	Premier’s Discovery Award in Science and Engineering (Ministry of Research and Innovation, Ontario)	500,000 (5 year duration)	Award presentation: April 24, 2007
Mandelis Andreas (PI) and Abrams Stephen	“Industrial Development of an Early Caries Detection Prototype using Dental Photothermal Radiometry and Modulated Luminescence-Phase III”, OCE Industrial Market Readiness Project awarded to Quantum Dental Technologies, Inc. , Toronto, ON.	75,000	October 1, 07 – Feb. 28, 08
Mandelis Andreas	“Development of advanced photoacoustic, photothermal and photocarrier techniques and biosensors for biomedical and optoelectronic diagnostics” NSERC Discovery Grant	53,080	April 1, 08 – March 31, 10
CHRP (NSERC-CHIR) A. Mandelis, PI;	“Development of a sensitive non-invasive biothermophotonic device for blood glucose	99,168/yr (avg.)	2008 - 2011

Andreas MANDELIS CV

B. Zinman, Co-Investigator	monitoring in patients with diabetes”, CHRP (NSERC-CIHR) award		
Canada Research Chairs, Tier I A. Mandelis	Canada Research Chair in Diffusion-Wave Sciences and Technologies	200,000/yr	October 2008 – Sept. 2015
A. Mandelis and Quantum Dental Technologies	“R&D for Photothermal Radiometry and Modulated Luminescence Early Caries Detection Systems” The Health Technology Exchange (HTX) Business Investment Program (OCE and NRC)	133,000	March 2009- April 2010
A. Mandelis (PI), A. Vitkin, S. Telenkov	The Photoacoustic Radar: Photothermoacoustic scanning tomography (PHAST) for early detection of breast cancer NSERC – Strategic Projects	132,325/yr	October 2009 – Sept. 2012
Mandelis Andreas	“Development of advanced photoacoustic, photothermal and photocarrier techniques and biosensors for biomedical, dental and optoelectronic diagnostics” NSERC Discovery Grant	60,000/yr	April 1, 2010 - March 31, 2015
Mandelis Andreas	“Research and development of two analytical instrumentation techniques: Photoacoustic-luminescence (PTA-LUM) radar/sonar and photothermal-luminescence (PTR-LUM) radar for early osteoporotic bone loss and density variation diagnosis”. Canada Council Killam Research Fellowship	70,000/yr	Sept. 2010 – August 2012
Mandelis Andreas	“Dental filling interface caries detection using photothermal radiometry and modulated luminescence” Quantum Dental Technologies, Inc.	15,167	March 2010-April 2011
Mandelis Andreas (PI), F. Gu (Univ. of Waterloo)	“Ultrasonic (US) Imager for enhanced resolution, contrast, and fast patient screening via co-registration with photoacoustic-radar tomographic (PART) imaging of breast cancer” NSERC Research Tools and Instruments (RTI)	139,739	April 2011 – March 2012
Mandelis Andreas (with Stackpole International)	“Non-Destructive Imaging of Manufacturing Flaws in Industrial Automotive Powder Metallurgy Green and Sintered Parts using a Novel IR Thermal-Wave Radar Technology” NSERC Strategic Project Grant	134,500/yr (avg.)	October 2012 – Sept. 2015
Mandelis A. (Nominated Principal Applicant); Foster S. (Principal Applicant)	“Hybrid (Co-registered) Intravascular Imaging Technology of Coronary Atherosclerosis using Wavelength-Modulated Differential Photoacoustic Radar and Ultrasonic Tomography” CHRP (CIHR-NSERC) Grant	269,721/yr (avg.)	April 2013- October 2018.
Mandelis A. (Supporting company: Pratt and Whitney Canada Corp. (PWC))	“Dynamic non-destructive thermographic imaging of nanocoating flaws in the Canadian aerospace Industry” NSERC Engage Grant	25,000	April – Sept. 2013
Mandelis A.	“Wavelength-Modulated Differential Photoacoustic Spectroscopy (WM-DPAS) Imager for very early detection of breast cancer”, Samsung Electronics, Korea, research contract (GRO)	149,299	November 2013 – October 2014
Mandelis A. (Supporting company: Alcohol Countermeasures Systems)	“Noninvasive In-Vehicle Alcohol Detection Biosensor” NSERC Engage Grant	25,000	Sept. 2013 – February 2014
Mandelis A. (Supporting company: Alcohol	“Development of a photothermal non-invasive in-vehicle alcohol detection biosensor- I”	242,856	April 2015 – March 2017

Andreas MANDELIS CV

Countermeasures Systems)	OCE-NSERC VIP-II (OCE Component)		
Mandelis A. (Supporting company: Alcohol Countermeasures Systems, 60 International Blvd., Toronto, ON, Canada )	“Development of a photothermal non-invasive in-vehicle alcohol detection biosensor- II” OCE-NSERC VIP-II (NSERC CRD Component)	142,856	April 2015 – July 2017
Mandelis A.	“Development of advanced dynamic imaging technologies for biomedical diagnostics and industrial non-destructive testing” NSERC Discovery Grant	77,000/year	April 2015 – March 2020
Mandelis A. (Supporting company : Integran Technologies, Inc., 6300 Northam Drive, Mississauga, ON, Canada)	“Non-destructive and non-contact characterization of nanostructured metal claddings on polymeric substrates” NSERC Engage Grant	25,000	September 2016 – February 2017
Canada Research Chairs, Mandelis A.	Canada Research Chair (Tier 1) in Diffusion-Wave and Photoacoustic Sciences and Technologies	200,000/year	October 2015 – September 2022
Mandelis A. (Nominated Principal Applicant), Finer Y. (Principal Applicant), and Tabatabaei N.	“Development of a high-resolution photothermal coherence tomography clinical device for detection and 3-D mapping of early dental caries “ CHRP (CIHR-NSERC) Grant	239,098/year	May 2017 – April 2020
Maldague X. (PI) ; P. Belanger, A. Bendada, T. Filleter, R. Maev, A. Mandelis, co-PIs	Innovative Program on NDT (NonDestructive Testing): oN DuTy! NSERC CREATE Program	150,000 (Year 1) 300,000 (Years 2-5)	May 2017-April 2023
Mandelis A.	“Development of dynamic Quantitative Lock-in Carrierography Imaging (Q-LICI) technology as a quality control tool for the electronics wafer process cleaning industry”, Connaught Innovation Award, Univ. Of Toronto	100,000	January – December 2018
Mandelis A.	“Wavelength-Modulated Intravascular Differential Photoacoustic Radar Imaging (IV-DPARI) catheter development for minimally invasive human coronary lipid-rich plaque arterial wall (intima) imaging diagnosis.” Connaught Innovation Award, Univ. of Toronto	50,000	January – December 2019

Average Government and Industrial support to the Center for Advanced Diffusion-Wave Technologies has been in the range of \$300,000 – 500,000 annually in recent years.

## XII. SCIENTIFIC AWARDS, SERVICE AND OTHER EVIDENCE OF IMPACT

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Date	Title-Description
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### I. Honors (Bolded), Scientific Appointments and Other Evidence of Impact

1970-74      **Fullbright Scholar, Yale University**

1974          **Valedictorian and Class Councillor; Yale College Class of '74.**

1988-89      Invited Professorship at ETH-Lausanne (EPFL), Switzerland.

1991-          Editor-in-Chief of the Series "PROGRESS IN PHOTOTHERMAL AND PHOTOACOUSTIC SCIENCE AND TECHNOLOGY", currently published by SPIE Press, Bellingham, WA; (Co-Editor: Prof. P. Hess, Karls



## Andreas MANDELIS CV

- Ruprecht University, Heidelberg, Germany; 26 - member International Advisory Board).
- 1990-93 Member of the Executive Board, APS Instrument and Measurement Science Topical Group (GIMS).
- 1990-96-00 Editorial Advisory Board, Analytical Sciences (Japan Society for Analytical Chemistry); Completed two terms.
- 1992 -96 Editorial Board, International Journal of Thermophysics.
- 1995 Chairman of the 2nd Gordon Conference on Photoacoustic and Photothermal Phenomena, New London, N.H., held June 11-16, 1995.
- 1993 ***Fellow of the American Physical Society.***
- 1993-96 Editorial Board, Review of Scientific Instruments.
- 1994-2000 Secretary/Treasurer of the APS Instrument and Measurement Science Topical Group (IMSTG).
- 1994 - Member of K7 (ASME) International Committee on Thermophysics.
- 1996 - 2004 Editorial Advisory Board of NDT&E International.
- Jan. 1997 - Associate Editor, AIP Review of Scientific Instruments.
- Jan. 1997- Dec. 1999 Editorial Board, AIP Journal of Applied Physics.
- Jan. 1997- Dec. 1999 Editorial Board, AIP Applied Physics Letters.
- Jan. 1998 - 2010 Senior Associate Editor, International Journal of Thermophysics (Springer, New York).
- Feb. 2001 – Founder and President of the International Photoacoustic and Photothermal Association (IPPA) (Co-founder: Prof. Gerald Diebold, Brown University), a Prize-awarding Society with headquarters in Toronto, ON, and Providence, RI.
- Nov. 2000-2006 Founder and first Chair of the Division of Instrumentation and Measurement Physics (DIMP), Canadian Association of Physicists.
- Nov. 2001 ***Recipient of the Alexander von Humboldt Research Award, Humboldt Foundation, Germany.***
- February 2003 ***Fellow of the International Society for Optical Engineering (SPIE).***
- October 2003 Was selected and received certificate of Outstanding Reviewer for 2003, ASME Journal of Heat Transfer.
- March 2004 ***Recipient of the 2004 New Pioneers Award in Science and Technology, Skills for Change, City of Toronto.***
- February 2006 Co-author of the 2006 Ontario Centres of Excellence Inc. Student Poster Competition Award (with A. Matvienko, R. Jeon and S. Abrams); accompanying cash award: \$2,000.
- June 2006 - Associate Editor, AIP Journal of Applied Physics.
- July 2006 ***Fellow, Royal Society of Canada, Academy of Sciences.***
- April 2007 ***Premier's Discovery Award in Science and Engineering, Ministry of Research and Innovation, Ontario: \$500,000 honorary research award.***

## Andreas MANDELIS CV

- 2008 - 09      Invited Editor, Special Issue of the Journal of Applied Physics in “Applied Biophysics” (published in May 2009).
- Nov. 2007      Appointed to Editorial Board, on-line journal “Diffusion Fundamentals” ([www.diffusion-online.org](http://www.diffusion-online.org))
- 2007            American Institute of Physics introduced PACS number 78.20.nc assigned to “photopyroelectric effects” pioneered by A. Mandelis
- 2008 \_2016      Founder and Chair of SPIE BiOS Conference on “*Optics in Bone Biology and Diagnostics*”, Photonics West San Jose, CA, USA; Name and venue changed in 2010 and beyond: Conference Chair, Organizer and session chair of the Conference. As of 2011 the Conference was renamed “*Optics in Bone Surgery and Diagnostics*”. Prof. Michael Morris (Univ. of Michigan) was appointed Conference Co-Chair in 2013.
- Oct. 2008      **Canada Research Chair (Tier I) in Diffusion-Wave Sciences and Technologies (2008 – 2015).**
- June 2009      **Yeram S. Touloukian Award in Thermophysics, ASME.**
- 2007            American Institute of Physics introduced PACS number 78.20.nc assigned to “Photopyroelectric Effects” pioneered by A. Mandelis and H. Coufal
- 2009            American Institute of Physics introduced PACS number 78.56.Cd assigned to “Photocarrier Radiometry” pioneered by A. Mandelis
- 2009            American Institute of Physics introduced PACS numbers 79.10.Ca and 79.10.na assigned to “Deep-level photothermal spectroscopy” pioneered by A. Mandelis.
- Mar. 2009      **2009 Senior Prize of the International Photoacoustic and Photothermal Association.**
- Mar. 2009      **2009 Canadian Association of Physicists (CAP) Medal for Outstanding Achievement in Industrial and Applied Physics.**
- Oct. 2009 -      Contributing Editor, New Products, Physics Today (American Institute of Physics).
- Dec. 2009 -      Member of Editorial Board, Journal of Biomedical Optics, SPIE, in charge of photothermal imaging, dental optics, and photoacoustic tomography.
- 2010 - 2014      Senior Editor, International Journal of Thermophysics (Springer, New York).
- Mar. 2010      **2010 Killam Research Fellowship** – Canada Council for the Arts. The Fellowship is worth \$70,000/yr for two years and allowed 100% release from teaching and administrative duties to dedicate to research project: “Research and development of two analytical instrumentation techniques: Photoacoustic-luminescence (PTA-LUM) radar/sonar and photothermal-luminescence (PTR-LUM) radar for early osteoporotic bone loss and density variation diagnosis”.
- 2010            Founder and Director of Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena (Professor Roberto Li Voti, University of Rome, co-founder), under the very prestigious umbrella of the Ettore Majorana summer schools, Center Ettore Majorana in Erice (Sicily, Italy), July 11-18, 2010.
- 2012-            Second Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena: Focus on BIOMEDICAL and NANOSCALE IMAGING and NDE”, Center Ettore Majorana in Erice (Sicily, Italy), April 19-26, 2012. The Workshop is within the auspices of Prof. Mandelis’ Canada Research Chairs mandate and has been approved as a biennial event.
- 2011-            Founder, Organizer and co-host (with Prof. F. Stuart Foster, Sunnybrook Health Sciences Centre) of the Annual Canadian Conference and Workshop on Photoacoustics (PA) and Photothermics (PT) of

## Andreas MANDELIS CV

Biosystems. First Conference: May 18, 2012. Second Conference: June 3, 2013.

- 2011 - Member of Scientific Advisory Board, Quantitative InfraRed Thermography (QIRT) Journal (Lavoisier Press, France).
- 2011 - A. Mandelis' biography included in the Canadian Who is Who (1910 - ), University of Toronto Press (<http://www.canadianwhoswho.ca/>)
- 2011, June 24 (**First Prize Winning Poster**) N. Tabatabaei and A. Mandelis, "Thermophotonic Radar Imaging of Turbid Media", Fields-MITACS Conf. on Mathematics of Medical Imaging, University of Toronto, June 20 – 24, 2011.
- 2012 ***The American Physical Society's 2012 Joseph F. Keithley Award for Advances in Measurement Science.***
- 2012 ***2012 Canadian Association of Physicists (CAP)-INO Medal for Outstanding Achievement in Applied Photonics***
- 2012 ***Fellow of the American Association for the Advancement of Science (AAAS).***
- 2012 ***Recipient of a Re-invitation Award from the Alexander von Humboldt Research Foundation for research leave at the Helmholtz Zentrum Munich, Institute for Biological and Medical Imaging (Technical University of Munich).***
- 2012 - Topical Editor, Optics Letters (Optical Society of America) for Photoacoustic Spectroscopy and Imaging.
- 2012 - Editorial Advisory Board, Photoacoustic Tomography (Versita Emerging Science Publishers).
- 2013 ***Inventor of the Year Award, University of Toronto***
- 2013 ***Fellow, Canadian Academy of Engineering***
- 2013 ***Fellow, American Society for Mechanical Engineering***
- 2014 May ***Laureate, Killam Prize in Engineering, Canada's highest academic prize awarded annually by the Governor General of Canada on behalf of the Killam Foundation and the Canada Council of the Arts. Five prizes of \$100,000 are awarded each year in recognition of outstanding career achievements (1 prize in each of 5 fields: humanities, social sciences, natural sciences, health sciences and engineering).***
- 2014 ***A. Mandelis' biography appeared on Wikipedia***, the free encyclopedia, under: [http://en.wikipedia.org/wiki/Andreas\\_Mandelis](http://en.wikipedia.org/wiki/Andreas_Mandelis)
- May 2014 Was selected Outstanding and Exceptional Reviewer for the AIP Review of Scientific Instruments (RSI Vol. **85**, 049801)
- June 12, 2014 Q.M. Sun, A. Melnikov, and A. Mandelis, "Quantitative Heterodyne Lock-in Carrierographic Imaging of Silicon Wafers and Solar Cells", 40th IEEE Photovoltaics Specialists Conference (PVSC-40), Denver, CO, June 8-13, 2014. Paper was selected for Best Poster Award.
- January 2015 - Editor-in-Chief, International Journal of Thermophysics (Springer)
- April 29, 2017 L. Hu, M. Liu, A. Mandelis, A. Melnikov, Q.M. Sun, E. H. Sargent, "Colloidal Quantum Dot Solar Cell Electrical Parameter Imaging Using Camera-based High-frequency Heterodyne Lock-in Carrierography", 44<sup>th</sup> IEEE Photovoltaics Specialists Conference (PVSC-44), Washington, DC, June 25-30, 2017. Lilei Hu and the paper was selected as Finalist in the Best Student Paper Award Competition.
- May 16, 2017 ***MIE Graduate Research Discovery Award*** to Edem Dovlo, PhD graduate given to a student who has

"successfully defended his/her PhD thesis within four years with an outstanding publication track record (top 5% of graduate students in the area), from their program, at the time of the oral."

- June 7, 2017 **Recipient of the Canadian NDT Research Award 2017**, Canadian Institute for Non-Destructive Evaluation (CINDE), presented at the annual CINDE Conference in Quebec City. Citation: "In recognition of outstanding and sustained excellence within NDT research and development that has contributed to innovation and breakthroughs benefiting Canadian society and industry partners".
- 2018 **Recipient of a second Re-invitation Award from the Alexander von Humboldt Research Foundation for research leave at the Helmholtz Zentrum Munich, Institute for Biological and Medical Imaging (Technical University of Munich).**
- 2018 **Distinguished Fellow, International Engineering and Technology Institute (IETI).** Citation: "for outstanding, rigorous, insightful and innovative contributions to engineering and technology, and for unselfish dedication in promoting the aims of the Institute".

### **XIII(a). INDUSTRIAL AND HEALTH-SECTOR COLLABORATIONS AND TECHNOLOGY TRANSFERS**

- 1) *Alcan International Ltd.*, Kingston, Ontario, (Dr. Mel Ball: Non-Destructive Evaluation Lab.): We performed a study of a complete technology transfer through the packaging of a can-thickness measuring thermal-wave radiometric instrument for non-contact on-line use with Alcan petfood canning factory in Germany. (1990's)
- 2) *Mitel S.C.C.* (currently Dalsa Semiconductors) , Bromont, Quebec (Mr. Yan Riopel, I.C. Process R & D): An Infrared photothermal radiometric instrument optimized for semiconductor inspection was developed to correlate Mitel's Si wafer electronic transport properties with their processing history, including cleaning agents, diffusion and ion implantation. (2000 – 2005)
- 3) *Ontario Hydro Technologies* (OHT), 800 Kipling Avenue, Toronto (Dr. S. Peralta, Electrical Systems Technology): A long-term relationship with OHT on depth profilometric evaluation of laser processed steels ended in 1997 with Hydro's restructuring. (1990's)
- 4) *Imperial Oil*, Sarnia, Ontario (Dr. Terrence Ashe, Sr. Research Chemist): A novel pyroelectric thermal-wave resonator cavity was introduced and tested successfully with Imperial's gasolines to ascertain its suitability as an on-site sensor of quality control at the pump level. (1990's)
- 5) *Union Carbide*, Washougal, WA (Dr. Milan Kokta, Crystal Growth Div.): Photopyroelectric spectroscopic methods developed at the University of Toronto were used to monitor the quality of Union Carbide's Ti:Sapphire laser rod surface polishes. (1992-95)
- 6) *Royal Canadian Mounted Police* (RCMP): The thermal-wave resonant cavity was tested successfully as a non-destructive evaluation (NDE) diagnostic tool of Canadian and US currency counterfeits. (1996-7)
- 7) *B&W Heating, Kitchener*, ON (Dr. Clare Beingessner, President): Thermal-wave depth profilometric inverse-problem technology was used for the non-destructive evaluation of case hardened industrial steels. (1998- 2002).
- 8) *Edison Welding Institute*, Columbus, OH (Dr. Bahram Farahbakhsh, NDE Group Leader): Thermal-wave NDE characterization of thermal-barrier coatings was tested successfully. (1998- 2000).
- 9) *Sputtek, Inc., Etobicoke*, ON (Dr. Lee Segal, President): We have developed an optical thermometer based on laser thermorefectance and thin-film interferometry principles for remote, non-contact monitoring of sputtered TiN coating temperatures and film growth in reactor chambers under vacuum. This technology is now at the Market Readiness phase under full development for industrial use by Sputtek and other coating companies, funded by Materials and Manufacturing Ontario. (2000 – 2006).
- 10) *Metex, Inc., Etobicoke*, ON (Mr. S. Bawa, President): A case-depth steel hardness monitoring instrument has been developed for fast, real-time control of the hardening process in industrial steel screws heat-treated by the Company, to replace slow and time-consuming indenter hardness measurements. The technology is the outcome of several years of

fundamental thermal-wave depth-profilometric inverse-problem studies. (2007 – 2009).

11) *Four Cell Consulting*, Toronto, ON (Dr. Stephen Abrams, DDS): A combined laser-based photothermal radiometric and modulated luminescence technology has been developed for monitoring early sub-surface carious lesions in teeth (enamel or dentin) occlusally or interproximally. The technology has exhibited sensitivity better than dental x-rays and superior lesion contrast without the risk of ionizing radiation. This technology has resulted in a Mandelis-Abrams partnership and the establishment of Quantum Dental Technologies, Inc., in Toronto. It markets the Canary™ early caries detection system (see entry # 14 below).

12) *Stackpole International*, Mississauga, ON (Roger Lawcock, Director of Technology): A laser photothermal technique for monitoring cracks in “green” and sintered automotive parts and sprockets was developed. The technique was proven to be able to detect cracks at inner corners and on flat surfaces of Stackpole’s green (pre-sintered) parts, unlike other NDT techniques. A systematic study of the photothermal signal behavior on the nature of these cracks was completed in 2009. That study led to a new collaboration for developing a crack imaging system for the Company based on the thermal-wave radar imager introduced in the CADIFT in 2010.

13) *Ultrasonix Medical Corp.*, Richmond, British Columbia, Canada: Development of a photoacoustic laser-based imager using a transducer phased array and co-registration of ultrasonic and photoacoustic images. The photoacoustic component is being developed as an accessory to the SonixTOUCH Research imaging apparatus marketed by Ultrasonix (2009 - )

14) *Quantum Dental Technologies (QDT) Inc.*, Toronto, ON. As a UofT spin-off company, QDT is a natural industrial collaborating partner with the CADIFT (Dr. Mandelis is the CTO of the Company). Primary contact person: Dr. Stephen Abrams, CEO. QDT, Inc., has supported several funded projects as an industrial partner with both in-kind and cash contributions. (2007 - )

15) *MDS Coating Technologies*, St. Laurent, Quebec. A preliminary (pilot) project on MDS multi-layered thermal barrier coating thermophysical property measurements was completed (2011).

16) *Avio S.p.A.*, Torino, Italy. Avio is Italy’s largest aerospace company. A collaboration with the CADIFT to develop steel microhardness non-destructive thermal-wave inspection techniques for large case depths in aerospace gears has produced very promising preliminary results using the thermal-wave pulse-compression radar pioneered in the CADIFT. (2010 - )

17) *Pratt and Whitney Canada, Toronto, ON*. A collaboration with PWC was developed in 2013-14 for dynamic non-destructive thermographic imaging of nanocoating flaws for aerospace components. The research is currently branching out into a new laser ultrasonic (photoacoustic) method for monitoring the stress state in PWC components coated with these nanocoatings which are used to extend fatigue life of crucial aerospace engine components (2013 -).

18) *Alcohol Countermeasure Systems, Toronto, ON*. A joint project is being pursued to develop an ethyl alcohol sensor for use in alcohol offenders’ vehicles, as well as for equipping the cars of the general public in order to make factual decisions on whether or not to drive after drinking. The non-invasive method used is Wavelength-Modulated Differential Photothermal Radiometry (WM-DPTR). (2013 - )

19) *Integran Technologies, Inc. Mississauga, ON*. A project has commenced on characterizing Integran’s mechanical strength properties of advanced metallurgical nano-technologies (coatings) in a non-destructive, non-contacting manner using laser photo-thermo-mechanical radiometry (PTMR), a novel optical strain-gauge method introduced in the CADIFT (2016 - ).

20) *Cannabix Technologies, Inc., Burnaby, BC*. Cannabix Technologies Inc. is a developing tools for law enforcement and the workplace to detect delta-9-tetrahydrocannabinol ( $\Delta^9$ -THC, or, simply, THC) - the psychoactive component of cannabis in breath. Our mid-infrared Wavelength-Modulated Differential Photothermal Radiometry (WM-DPTR) technology is currently being tested with specialty quantum cascade laser sources for monitoring the concentration of THC in the interstitial fluid of the human finger, with the goal to develop WM-DPTR as an effective non-invasive roadside technology for police force use in Canada and worldwide in evaluating the level of impairment of drivers under the influence of cannabis.

21) *Conavi Medical, North York, ON*. An ongoing project on endoscopic imaging of coronary arteries via jointly designed quasi-invasive catheters using frequency domain photoacoustic spectroscopy has led to joint research and

development with a next phase planned IP assignment to the company of a 3-D imaging catheter.

22) (2013–2016): *Samsung Electronics, South Korea*. Development of ultrasound / hybrid acoustic system for molecular imaging: “Wavelength-Modulated Differential Photoacoustic Spectroscopy Imager for very early detection of breast cancer”.

23) (2018 – present): *Advanced Processing Equipment Technology (APET), South Korea*. Development of the CADIPT imaging technique Heterodyne Lock-in Carrierography (HeLIC) into an inspection tool for the company's semiconductor wafer surface cleaning TeraDox process to meet today's atomically pristine semiconductor wafer surface requirements. Currently, HeLIC imaging instrumentation technology is under intense testing involving several US semiconductor wafer and device fabrication companies toward development of a new inspection tool for device process quality control.

### **XIII(b). ACADEMIC LOCAL, NATIONAL AND INTERNATIONAL COLLABORATIONS (PAST AND ONGOING)**

1) 2010 - present: BONE LOSS (OSTEOPOROSIS) DIAGNOSIS INSTRUMENTATION & METHODOLOGY. Ongoing collaboration with Dr. Marc Grynblas, Mount Sinai Hospital, Bone Biology Lab., Samuel Lunenfeld Research Institute, and with Dr. Thomas Willett, Mount Sinai Hospital, Division of Orthopaedic Surgery, Samuel Lunenfeld Research Institute. The collaboration has resulted in a further collaboration with Professor Richard S. Cobbold, IBBME.

2) 2008 - present: BLOOD GLUCOSE BIOSENSOR DEVELOPMENT Ongoing collaboration with Dr. Bernard Zinman, Director, Samuel Lunenfeld Diabetes Center, Mount Sinai Hospital.

3) 2006 – present: DENTAL THERMOPHOTONIC IMAGING Ongoing collaboration with Prof. Yoav Finer, Dept. of Dentistry, UofT, and Dr. Stephen Abrams (DDS, Cliffcrest Dental Clinic, Scarborough). This activity resulted in a successful dental instrumentation spin-off company (Quantum Dental Technologies, QDT, Inc.)

4) 2008 – present: ANALYTICAL SPECTROSCOPIC TECHNIQUES FOR CHARACTERIZATION OF BIOMATERIALS. Ongoing collaboration with Dr. Kirk Michaelian, Research Scientist and Manager, Advanced & Standard Analytical Group, Natural Resources Canada, Innovation and Energy Technology Sector, CanmetENERGY–Devon, AB.

5) 2004 – present: BIOMEDICAL PHOTOACOUSTIC IMAGING. Ongoing collaboration with Dr. Alex Vitkin (Princess Margaret Hospital) and a new collaboration with ultrasound specialist Dr. Stuart Foster of Sunnybrook Hospital, Toronto, ON, on biomedical photoacoustic imaging.

6) 2010- present: NANOPARTICLE-BASED CONTRAST ENHANCEMENT IN PHOTOACOUSTIC RADAR IMAGING. Ongoing collaboration with Professor Frank Gu, Dept. of Chemical Engineering, Univ. of Waterloo.

7) 2010 – present: LOCK-IN AND HETERODYNE CARRIEROGRAPHIC IMAGING OF SOLAR CELLS. With Prof. Nazir Kherani, ECE, UofT. Dr. Kherani and I intend to develop the new techniques for quality control in the solar-cell industry.

8) 2009 – present: PHOTOCARRIER RADIOMETRY OF QUANTUM-WELL SOLAR CELLS. An ongoing collaboration with Prof. Edward (Ted) Sargent, ECE, UofT.

9) 2013 - : INTRAVASCULAR PHOTOACOUSTIC IMAGING USING A HYBRID CATHETER. A first-time collaboration with Dr. Stuart Foster, Sunnybrook Health Sciences Centre and Dr. Brian Courtney, heart surgeon and President, Colibri Technologies, Toronto, ON, to the development of a co-registered photoacoustic and ultrasonic catheter imager for coronary artery disease diagnosis.

10) 2009 – present: BLOOD GLUCOSE BIOSENSOR. An ongoing collaboration with Pranalytica, Inc., Santa Monica, CA USA.

11) 2012 – present: BIOMEDICAL ASPECTS OF FREQUENCY-DOMAIN PHOTOACOUSTIC IMAGING. A growing collaboration with the Helmholtz Zentrum Muenchen (Technical University of my 2012-13 sabbatical research leave as part of my Humboldt Re-invitation Award.

- 12) 2011 – present: DIFFUSION-WAVE DIAGNOSTIC AND IMAGING INSPECTION METHODS FOR OPTOELECTRONIC MATERIALS AND DEVICES. A growing collaboration with the University of Electronic Science and Technology of China (UESTC), Chengdu, China, Professor Gao Chunming, Vice Dean, School of Optoelectronic Information.
- 13) 2007- present: DEVELOPMENT OF ADVANCED MATHEMATICAL THERMAL-WAVE METHODOLOGIES FOR THE QUANTITATIVE ASSESSMENT OF THERMOPHYSICAL PROPERTIES OF CURVILINEAR AND FINITE GEOMETRY SOLIDS. Ongoing collaboration with Soochow University, Suzhou, Jiangsu, China, Professor Chin-Hua Wang.
- 14) 2012 - 2014: ADVANCED DYNAMIC INFRARED THERMOGRAPHIES FOR THE NON-DESTRUCTIVE TESTING OF INDUSTRIAL MANUFACTURED MATERIALS. Collaboration with the University of the Basque Country, Spain, Professor Agustin Salazar.
- 15) 2011 – present: THEORETICAL AND EXPERIMENTAL INFRARED IMAGING TECHNIQUES OF SPATIALLY THERMALLY ANISOTROPIC COATINGS. Ongoing collaboration with the University of Applied Sciences, Wels, Austria, Professor and Acting Dean Guenther Hendorfer.
- 16) 2013 – 2015: GRO Medical Technology: Ultrasound/Hybrid Acoustic Imaging System for Molecular Imaging: “Wavelength-Modulated Differential Photoacoustic Spectroscopy (WM-DPAS) Imager for very early detection of breast cancer” Samsung Electronics Co. Ltd., Suwon, South Korea.
- 17) 2016 – present: ADVANCED THERMAL-WAVE COHERENCE THERMOGRAPHIES FOR THE NON-DESTRUCTIVE TESTING OF INDUSTRIAL MANUFACTURED MATERIALS. Collaboration with Laval University (Quebec City), Canada, Professor Xavier Maldague.

#### XIV. SCIENTIFIC AND PROFESSIONAL ACTIVITIES

Date	Association	Capacity
<b>SCIENTIFIC AND TECHNICAL JOURNAL REVIEWS (Current and Past)</b>		
1983 -	Acustica, Advances in Condensed Matter Physics Analytical Chemistry, ASME Journal of Heat Transfer, Applied Optics, Applied Physics A and B, Applied Physics Letters, Applied Spectroscopy, Biomedical Optics Express, Canadian Journal of Physics, European Journal of Physics IEEE Sensors Journal IEEE Trans. Ultrasonics, Ferroelectrics, and Frequency Control (UFFC), Infrared Physics & Technology, International Journal of Thermal Sciences, International Journal of Thermophysics, IOP European Journal of Physics – Several journals: Journal of Physics: Condensed Matter Journal of Optics A-Pure and Applied Optics Measurement Science and Technology Physics in Medicine and Biology	

Journal of the Acoustical Society of America,  
 Journal of Applied Physics,  
 Journal of Biomedical Optics,  
 Journal of Biophotonics,  
 Journal of the Franklin Institute,  
 Journal of Optical Society of America A and B,  
 Journal of Physical Chemistry,  
 Journal of Vacuum Science and Technology,  
 Micro & Nano  
 Nature Communications  
 Nature Photonics  
 NDT&E International  
 Optics Express,  
 Optics Letters,  
 Physica B,  
 Physica Status Solidi (A and B),  
 Physical Review Letters,  
 Physical Review B,  
 Physical Review E,  
 Physics in Canada,  
 Physics in Medicine and Biology,  
 Physics Letters A,  
 Physics Today,  
 Proceedings of the Royal Society A,  
 Review of Scientific Instruments,  
 Semiconductor Science and Technology,  
 Sensors and Actuators,  
 Spectrochimica Acta A,  
 Thin Solid Films

**COMMITTEES**

*Canadian:* NSERC, CIHR, CHRP; NSERC Industrial Research Chair Committees.  
 NSERC and NSF Grant proposals; numerous Academic Promotion and Tenure Review Committees,

*USA:* NSF, NIH, Department of Energy, and several National Laboratories: Argonne, Battelle; ASME K-7  
 Committee on Thermophysics;

*International:* Belgium Research Foundation, Austrian COMET Program, Cyprus Research Promotion  
 Foundation (RPF);

**MEMBERSHIPS IN LEARNED SOCIETIES**

1979	American Physical Society	Fellow (as of 1993) and Lifetime Member
1980 - 90	Sigma Xi Scientific Research Society	Full Member
1980 -	Canadian Association of Physicists	Full Member
1986-90	IEEE	Full Member
1986-90; 2002-	ASME (American Society of Mechanical Engineers)	Full Member, Fellow (as of 2013)
1994-96	Society for Applied Spectroscopy	Full Member



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- 1993- Society of Photo-Optical Instrumentation Engineers (SPIE) Full lifetime member; Fellow (as of 2003)
- 2007 - International Association for Dental Research (IADR) Member
- 2010 - American Association for the Advancement of Science (AAAS) Full Member; Fellow as of 2012

### **SCIENTIFIC AND PROFESSIONAL ACTIVITIES**

- 1983-84 Invited co-organizer/Scientific Program Committee, 4th International Conference in Thermal Wave Sciences, École Polytechnique, Montréal, Québec, Summer 1985
- 1988-89 Invited co-organizer/Scientific Program Committee; Session Chair: "Biology and Medicine"; and Proceedings Review and Publication Panel. 6th International Conference on Photoacoustic and Photothermal Phenomena, John's Hopkins University, Baltimore, MD, July 31 – Aug. 3 1989.
- 1989 Invited organizer and Chair. Two invited symposia of the Instrumentation and Measurement Science Topical Group: Photoacoustic and Photothermal Instrumentation and Measurement: I-Symposium 15, March 22, II- Symposium L5, March 22. American Physical Society: March Meeting, March 20-24, 1989, St. Louis, MO.
- 1990 Invited Session Chair: "Topic A: Photoacoustics" Catholic Univ. Kortrijk, June 19-22 Symposium on Physical Acoustics.
- 1990 Organizer and chair: Invited symposium of the Instrumentation and Measurement Science Topical Group: Photoacoustic and Photothermal Instrumentation and Measurement: I-Symposium 15, March-II Symposium L5, March 22. American Physical Society March Meeting, March 12-16, 1990, Anaheim, CA.
- 1990 Co-chair of Session on Photothermal Spectroscopy. Federation of Analytical Chemistry and Spectroscopy Societies, 17th Annual Meeting (FACSS XVII), October 7-12, Cleveland, OH
- 1991 Session Chair: "Experimental Techniques and Instrumentation". 7th International Conference on Photoacoustic and Photothermal Phenomena, Doorwerth, Holland, August 26-31.
- 1992 Organizer and chair: Invited symposium of the Instrumentation and Measurement Science Topical Group: Photoacoustic and Photothermal Instrumentation; Symposium K3, March 18 American Physical Society: March Meeting, March 16-20, 1992, Indianapolis, IN.
- 1992-95 Director, Canadian Association for Research in Non-Destructive Evaluation (CARNDE)
- 1992 Member of International Committee. Proceedings Review and Publication Panel, 8th International Topical Meeting on Photoacoustic and Photothermal Phenomena, Pointe-à-Pitre, Guadeloupe (France), Jan. 22-25, 1994
- 1994 Special Session organizer and chair: "Laser Photothermal, Techniques". 12th Symposium on Thermophysical Properties (NIST), Boulder, CO, June 19-24.
- 1995 Guest Editor, Special issue on Photopyroelectric Spectroscopy and Detection, Ferroelectrics, Vol. **165**, Numbers 1-2.
- 1995-96 Member of International Committee, 9th International Conference on Photoacoustic and Photothermal Phenomena, Nanjing, China, June 27-30, 1996.
- 1997 Guest Editor (K. Michaelian, co-editor), SPIE Optical Engineering Vol. **36**, Number 2, February 1997 (Special Section on Photoacoustic and Photothermal Science and Engineering,.)
- 1997 Organizer and Chair: Invited Symposium on "Advanced Semiconductor Characterization; Instrumentation

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and Techniques", Co-sponsored by the Instrumentation and Measurement Science (IMSTG) and Forum for Industrial and Applied Physics (FIAP). American Physical Society: March Meeting March 17-21, 1997, Kansas City, MO.

- 1997 Organizer and Chair of Invited Session on "Inverse Problems. III Int. Workshop on "Advances in Signal Processing for NDE of Materials", Quebec City, P.Q., August 5-8, 1997.
- 1998 Member of International Committee, 10th International Conference on Photoacoustic and Photothermal Phenomena, Rome, Italy.
- 1998 Organizer and Chair: Invited Symposium on "Measurement Methods of Imaging Science and Non-Destructive Evaluation". American Physical Society: March Meeting, March 16-20, 1998, Los Angeles, CA.
- 2000- Program Committee: Biomedical Optoacoustics (BIOS annual Conf. On Biomedical Optics, San Jose, CA; SPIE)
- 2000-2001 Consultant to Physical Chemistry Division of the IUPAC, re. "Quantities, Terminology and Symbols in Photothermal and Related Spectroscopies"
- 2000-2002 Chair, Organizer and Host of the 12<sup>th</sup> Int. Conference on Photoacoustic and Photothermal Phenomena, June 24-27, 2002, Toronto, ON, Canada.
- 2001- Member of the Council, Canadian Association of Physicists
- 2000-2004 Annually organized and chaired sessions in SPIE's Biomedical Optoacoustics I - IV (BIOS, San Jose, CA; A. Oraevsky, Chair).
- 2002-03 Co-Chair of 15<sup>th</sup> Symposium on Thermophysical Properties, June 22-27, 2003, Boulder, CO (Organized by NIST)
- 2004 International Scientific Committee Member, 13<sup>th</sup> Int. Conference on Photoacoustic and Photothermal Phenomena, Rio de Janeiro, Brazil
- 2004 Technical Program Committee; Noise and Information in Nanoelectronics, Sensors and Standards, 2<sup>nd</sup> SPIE Int. Symp. Fluctuations and Noise, Maspalomas, Grand Canaria, Spain, May 26 -28, 2004.
- 2004 Member of the Council, Canadian Association of Physicists (CAP).
- 2004. CAP 2004 Congress Co-Organizer and Chair of 6 invited and contributed sessions, Winnipeg, MAN, June 14-16.
- 2005 Technical Program Committee; Noise and Information in Nanoelectronics, Sensors and Standards, 2<sup>nd</sup> SPIE Int. Symp. Fluctuations and Noise, Austin, TX.
- 2005-06 Co-Chair and Member of Executive Board of 16<sup>th</sup> Symposium on Thermophysical Properties, July 2006, Boulder, CO (Organized by NIST)
- 2005-06 Executive Board, "Thermo International 2006" (Comprises: 16<sup>th</sup> Symposium on Thermophysical Properties; 19<sup>th</sup> International Conference on Chemical Thermodynamics; and 61<sup>st</sup> Calorimetry Conference), July 2006, Boulder, CO (Organized by NIST)
- 2006 International Scientific Committee Member, 14<sup>th</sup> Int. Conference on Photoacoustic and Photothermal Phenomena, Cairo, Egypt
- 2005- 06 Member of the Scientific Committee, 9<sup>th</sup> European Conference for Non-Destructive Testing (ECNDT), Berlin, Sept. 25- 29, 2006

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- 2005 – 06: Guest Editor, Physics in Canada Special issue on Instrumentation and Measurement Physics, Vol. **62** (2) March/April 2006.
- 2005 - Annual Conference Chair in SPIE Photons Plus Ultrasound and Biomedical Thermoacoustics, Optoacoustics and Acousto-Optics, (BIOS 2005 - , San Jose, CA; A. Oraevsky and L. V. Wang, Co-Chairs).
- 2006 CAP 2006 Congress Co-Organizer and Chair of 8 invited and contributed sessions, Division of Instrumentation and Measurement Physics (DIMP), St. Catharines, ON, June 11 -14, 2006.
2006. Organizer and Chair, Biothermophotonics and Bioacoustophotonics Sessions, International Conference on Applications of Photonic Technology, Québec City, QC, June 5-8, 2006.
2006. Organizer and Chair, Session: “Properties of Solids”, 16<sup>th</sup> Symp. Thermophys. Prop., July 30 – Aug. 4, 2006 (Boulder, CO)
- 2006 Co-organizer, Session “Property Needs in Biothermophotonics”, 16<sup>th</sup> Symp. Thermophys. Prop., July 30 – Aug. 4, 2006 (Boulder, CO)
2007. APS March Meeting, Group for Instrumentation Science (GIMS) Focus Session Organizer: 1) Session B38: Bioinstrumentation and Biophotonic Technologies; 2) Session A38: Acoustic and Optical Instrumentation.
2007. Session Chair, “Radiography and Tomographic Methods”, 4<sup>th</sup> Int. Conf. Emerging Technologies in Non-Destructive Testing, April 2-4, 2007 (Stuttgart, Germany).
- 2007 - Virtual Researcher on Call ([www.vroc.ca](http://www.vroc.ca)) Conducts teleconference tutorial lectures for Ontario high school students on the thematic area of “Waves and diffusion waves”. VROC works with Canadian University research professors and aims to inspire high-school students to careers in research.
- 2007 Member of International Scientific Committee, 4<sup>th</sup> Int. Conf. Emerging Technologies in Non-Destructive Testing, April 2-4, 2007 (Stuttgart, Germany).
- 2007 - Program Committee Member, SPIE BiOS (Photonics West) Annual Conference on: Photons Plus Ultrasound: Imaging and Sensing.
- 2007 – 2009 International Scientific Committee Member, 15th Int. Conference on Photoacoustic and Photothermal Phenomena, Leuven, Belgium.
- 2008-09 Organizer and Session Chair, 17th NIST/ASME Symposium of Thermophysical Properties, June 2009, Boulder, CO (Organized by the NIST)
- 2009 - Founder and Chair, SPIE BiOS Conference # 7166 “Optics in Bone Biology and Diagnostics”; inaugurated January 23, 2009 in San Jose, CA, USA.
- 2010 Conference chair, organizer and session chair, SPIE BiOS Conference # 7548F “Optics in Bone Biology and Diagnostics”; January 2010, San Francisco, CA, USA.
- 2009 – 10 Member of the International Program Committee, Advanced Laser Technologies (ALT '10), Radboud University Nijmegen, Netherlands, Sept. 11 – 16, 2010.

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- 2009 – 10 Member of International Scientific Committee and Chair of Photothermal, photoacoustic and diffusion-wave sessions of Quantitative Infrared Thermography (QIRT) 10 (Sponsor: IEEE), July 27 – 30, 2010, Universite Laval, Quebec City, PQ.
- 2010 - 2011 Co organizer (with Dr. Stuart Foster) of the Ontario Photoacoustics Workshop, Sunnybrook Research Institute, Toronto, ON. The Workshop is dedicated to biomedical photoacoustics, imaging and related topics.
- 2010 - Member of the International Program Committee, Advanced Laser Technologies (ALT '10), Radboud University Nijmegen, Netherlands, Sept. 11 – 16, 2010.
- 2010 - 11 Member of International Scientific Committee and Proceedings Editor, 16th Int. Conference on Photoacoustic and Photothermal Phenomena, CINVESTAV, Merida, Mexico, Nov. 2011.
- 2010 - 11 Program Committee Member, SPIE BiOS 2011 Conference on: Photons Plus Ultrasound: Imaging and Sensing, January 2011.
- 2011: Session Chair, SPIE BiOS Conference # 7899 “Photons Plus Ultrasound: Imaging and Sensing 2011”, Session 8: Novel Designs, Systems and Techniques, January 24, 2011.
- 2010 – 2011: Member of scientific committee, 5th Int. Conf. on Emerging Technologies in NDT, September 19 – 21, 2011, Ioannina, Greece.
- 2010\_11 Organizer, coordinator, and opening presenter of a Special Session on “Photothermal and Photoacoustic Thermophysics”, during the 19th European Conference on Thermophysical Properties, Thessaloniki, Greece, August 28 – Sept. 1, 2011. Seven leading researcher presentations in this field have been arranged as a special event.
- 2011 Conference Chair, organizer and session chair, SPIE BiOS Conference # 7883F “Optics in Bone Biology and Diagnostics”; January 22, 2011, San Francisco, CA, USA.
- 2011 Session Chair, SPIE BiOS Conference # 7899 “Photons Plus Ultrasound: Imaging and Sensing 2011”, Session 8: Novel Designs, Systems and Techniques, January 24, 2011.
- 2010-11 Member of Scientific Committee, Int. Congress on Ultrasonics, Inst. of Experimental Physics, Univ. of Gdansk, Poland, 5 – 8 Sept. 2011
- 2011 Member of Scientific Committee, Diffusion Fundamentals IV, August 21<sup>st</sup> – 24<sup>th</sup>, Rensselaer Polytechnic Institute, Troy, NY, USA
- 2011 Session Chair, Special Session on Photothermal and Photoacoustic Thermophysics 1, 19th European Conf. on Thermophysical Properties, Thessaloniki, Greece, August 28 – Sept. 1, 2011.
- 2010 Session Chair, Special Session on Photothermal and Photoacoustic Thermophysics 2, 19th European Conf. on Thermophysical Properties, Thessaloniki, Greece, August 28 – Sept. 1, 2011.
- 2011 Plenary Session Chair, Tuesday Nov. 29; speaker: Vladimir Zharov, “Photoacoustic flow cytometry for early diagnosis of cancer”, 16th Int. Conf. on Photoacoustic and Photothermal Phenomena (ICPPP), Merida, Mexico, Nov. 27 – Dec. 1, 2011.
- 2010-11 Session Chair, Tuesday Nov. 29: “Medical, Dental and Biological Applications”, 16th Int. Conf. on Photoacoustic and Photothermal Phenomena (ICPPP), Merida, Mexico, Nov. 27 – Dec. 1, 2011.
- 2011 Guest Editor (with Dan Fried and Mike Morris), Special Section of J. Biomed. Opt. Vol. **16** (7), July 2011: “Hard Tissue Optics and Related Methods”.

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- 2011 Conference Chair, organizer and session chair, SPIE BiOS Conference # BO109, "Optics in Bone Surgery and Diagnostics"; January 21-26, 2012, San Francisco, CA, USA.
- 2011\_12 Program Committee Member, SPIE BiOS 2012 Conference on: Photons Plus Ultrasound: Imaging and Sensing, January 2012.
- 2011\_12 Chair of International Photoacoustic and Photothermal Association (IPPA) 2011 Prize awarding ceremony, Wednesday Nov. 30, 16th Int. Conf. on Photoacoustic and Photothermal Phenomena (ICPPP), Merida, Mexico.
- 2011-12 Organizer and Session Chair, 18th NIST/ASME Symposium of Thermophysical Properties, June 2012 Boulder, CO (Organized by the NIST): *Photothermal and Photoacoustic Techniques* 1 (Nanoparticles), 2 (Material Structure and Phase Change), 3 (Fluids, Liquids, and Mixtures), 4 (Methodology and Thin Films); *Thermophysical Methods for Biomaterials and Biosystems* (with J. J. Alvarado-Gil) 1 (Molecules and Proteins), 2 and 3 (Medical and Other Applications), 4 (Macroscopic Systems); *Inverse Problems and Non-Destructive Evaluation* (with R. Li Voti) 1 (Inverse Problems), 2 (Non-destructive Evaluation).
- 2011-12 Director (with Professor Roberto Li Voti) of Second Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena: Focus on BIOMEDICAL and NANOSCALE IMAGING and NDE", Center Ettore Majorana in Erice (Sicily, Italy), April 19-26, 2012.
- 2012: Founder and co-organizer (with Dr. Stuart Foster) of the First Canadian Conference and Workshop on Photoacoustics (PA) and Photothermics (PT) of Biosystems. Sunnybrook Research Institute, Toronto, ON, Friday May 18, 2012.
- 2012 Member of the International Program Committee, Advanced Laser Technologies (ALT '12), Thun, Switzerland, Sept. 2 – 6, 2012.
- 2012-13 Conference Chair, organizer and session chair, SPIE BiOS Conference # 8565H, "Optics in Bone Surgery and Diagnostics"; February 2-7, 2012, San Francisco, CA, USA.
- 2012-13 Member of the Scientific Committee, Conference on Photoacoustic and Photothermal Theory and Applications (CPPTA), Warsaw (Poland), September 25th to 27th, 2013.
- 2013 Scientific Committee Member, Seventh International Workshop on Advances in Signal Processing for Non Destructive Evaluation of Materials (IWASPNDE), 31st of July - August 2nd 2013, Quebec City (Quebec), Canada.
- 2012-13 Member of the Scientific Committee, 17th Int. Conf. on Photoacoustic and Photothermal Phenomena (ICPPP), Suzhou, China.
- 2013 Member of the Scientific Committee, Diffusion Fundamentals V, Universität Leipzig in Leipzig/Germany, August 26–28th, 2013.
- 2013 Member of the International Program Committee, Advanced Laser Technologies (ALT '13), Budva, Montenegro, Sept. 16 - 20, 2013.
- 2013 Co-organizer (with Dr. Stuart Foster) of the Second Canadian Conference and Workshop on Photoacoustics (PA) and Photothermics (PT) of Biosystems. Sunnybrook Research Institute, Toronto, ON, June 3, 2013.
- 2013 Conference Chair, organizer and session chair, SPIE BiOS Conference # 8565, "Optics in Bone Surgery and Diagnostics", February 2-7, 2013, San Francisco, CA.

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- 2014 Conference Chair, organizer and session chair, SPIE BiOS Conference # 8926, "Optics in Bone Surgery and Diagnostics", February 1-6, 2014, San Francisco, CA.
- 2014 Session chair, SPIE BiOS Conference # "Photons Plus Ultrasound: Imaging and Sensing 2014", Session 15: "Novel Approaches and Technological Enhancements I", BiOS (Photonics West), February 5, 2014, San Francisco, CA.
- 2014 Member of the International Program Committee, Advanced Laser Technologies (ALT '14), 6 - 10 October 2014, Cassis, France.
- 2014 Session Chair, Ultrasonic Testing, Far East Forum on Non-Destructive Evaluation/Testing (FENDT) 2014, Chengdu, China, June 21, 2014.
- 2014 Director (with Professor Roberto Li Voti, co-director) of Third Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena: Focus on BIOMEDICAL and NANOSCALE IMAGING and NDE", Center Ettore Majorana in Erice (Sicily, Italy), October 5-12, 2014.
- 2014 Session Chair, 3<sup>rd</sup> Mediterranean International Workshop on Photoacoustic & Photothermal Phenomena.  
1) Session "Foundations and Techniques", October 6, 2014.  
2) Session A (Morning) "Biomedical and Biological PA&PT", October 7, 2014  
3) Session A (Afternoon) "Biomedical and Biological PA&PT", October 7, 2014  
4) Session C (Morning) "Non-Destructive Evaluation & Testing II", October 10, 2014  
5) Evening session on: FLIR exhibition and LENR Seminars, October 10, 2014.  
6) Afternoon session: Presentation of the next events and conclusions", October 11, 2014
- 2014-15 Member of scientific committee, 6th Int. Conf. on Emerging Technologies in NDT, May 27 - 29, 2015, Brussels, Belgium.
- 2015 Conference Chair, organizer and session chair, SPIE BiOS Conference # 9303 (BO110), "Optics in Bone Surgery and Diagnostics", February 7-12, 2015, San Francisco, CA.
- 2015 Session chair, SPIE BiOS Conference # "Photons Plus Ultrasound: Imaging and Sensing 2015", Session 6: "Signal Processing and Image Reconstruction" BiOS (Photonics West), February 9, 2015, San Francisco, CA
- 2015 Member of the International Program Committee, Advanced Laser Technologies (ALT '15), 7 - 11 September 2015, Faro, Portugal.
- 2015 Member of the International Scientific Committee, Diffusion Fundamentals VI, Dresden, Germany, August 23-26, 2015.
- 2014-15 Member of the International Scientific Committee and the International Steering and Advisory Committee, 18th Int. Conf. on Photoacoustic and Photothermal Phenomena (ICPPP18), Novi Sad, Serbia, Sept. 6-10, 2015
- 2015 Organizer and Chair, Special sessions, Research for Industry, session 1 (9:30 12:00 pm) and session 2 (1:00 pm 2:30 pm), NDT in Canada 2015, Marriot River Cree Resort and Casino, Edmonton, AB, June 16 2015.
- 2015 Organizer and Chair, Special session: Panel Discussion: Industry/Academia (3:00 – 4:00 pm), NDT in Canada 2015, Marriot River Cree Resort and Casino, Edmonton, AB, June 16 2015.
- 2014-15 Member of Organizing Committee, 19th NIST/ASME Symposium of Thermophysical Properties, June 21-26, 2015 Boulder, CO (Organized by the NIST):  
*Photothermal and Photoacoustic Techniques; Thermophysical Methods for Biomaterials and Biosystems* (with J. J. Alvarado-Gil); *Inverse Problems and Non-Destructive Evaluation* (with X. Maddague and R. Li Voti).

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- 2015 Organizer and Chair, Session: Photothermal and Photoacoustic Techniques 1, June 22 (1:50 – 3:30 pm), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Organizer and Chair, Session: Photothermal and Photoacoustic Techniques 2, June 22 (3:55 – 4:55 pm), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Organizer and Chair, Session: Photothermal and Photoacoustic Techniques 3, June 22 (7:35 – 9:15 pm), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Co-organizer and co-chair (with X. Maldague and R. LiVoti), Session: Inverse Problems and Non-Destructive Evaluation 1: Inverse Techniques, June 23 (8:30 – 10:15 am), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Co-organizer and co-chair (with X. Maldague and R. LiVoti), Session: Inverse Problems and Non-Destructive Evaluation 2: NDE by Thermography and Radiometry, June 23 (10:35 am – 11:20 pm), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Chair, session “Non-equilibrium Thermodynamics 2: Non-equilibrium Fluctuations in Fluids, June 23 (1:45 – 3:30 pm), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Co-organizer and co-chair (with J. J. Alvarado-Gil), Session: Thermophysical Methods for Biomaterials and Biosystems 1, June 24 (8:35 – 9:55 am), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Co-organizer and co-chair (with J. J. Alvarado-Gil), Session: Thermophysical Methods for Biomaterials and Biosystems 2, June 24 (10:35 am – 12:00 pm), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Co-organizer and co-chair (with X. Maldague and R. LiVoti), Session: Inverse Problems and Non-Destructive Evaluation 3: NDE by Other Techniques, June 24 (1:45 – 3:30 pm), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2015 Co-organizer and co-chair (with J. J. Alvarado-Gil), Session: Thermophysical Methods for Biomaterials and Biosystems 3, June 24 (7:30 – 8:55 pm), 19th Symposium on Thermophysical Properties, Boulder CO, June 21-26, 2015.
- 2016 Member of Scientific Programme Committee, 19<sup>th</sup> World Conference on Non-Destructive Testing (WCNDT), June 13 – 19 (2016), Munich, Germany.
- 2016 Conference Chair, organizer and session chair, SPIE BiOS Conference # 9689F, “Optics in Bone Surgery and Diagnostics”, February 13, 2016, San Francisco, CA.
- 2016 Session chair, SPIE BiOS Conference # “Photons Plus Ultrasound: Imaging and Sensing 2016”, Session 6 : “Signal Processing and Image Reconstruction” BiOS (Photonics West), February 16, 2016, San Francisco, CA
- 2016 Director (with Professor Roberto Li Voti, co-director) of “Fourth Mediterranean International Workshop and Summer Graduate School on Photoacoustic & Photothermal Phenomena: Focus on BIOMEDICAL and NANOSCALE IMAGING and NDE”, Center Ettore Majorana in Erice (Sicily, Italy), October 19-26, 2016.
- 2016 Session Chair, BIT's 9th Annual World Cancer Congress-2016, Shanghai, China, May 14-16, 2016.
- 2016 Session Chair, Ultrasonics 2016; II international conference on ultrasonic based applications, Caparica, Portugal, June 6-8, 2016. Session 031, June 8.

## Andreas MANDELIS CV

- 2016 Session Chair, 19<sup>th</sup> World Conference on Non-Destructive Testing, Munich, Germany, June 13-17, 2016. Session We.2.I, “Composite Materials – Thermography”, June 15, 10:40 am – 12:20 pm.
- 2016-17 Member of Scientific International Committee, 19<sup>th</sup> International Conference on Photoacoustic and Photothermal Phenomena (ICPPP19); Bilbao, Spain. July 16-20, 2017
- 2017 Scientific Advisory Committee Member, 2017 Diffusion Fundamentals (Int’l Conference Diffusion Fundamentals VII), July 3 – 7, Moscow, Russia.
- 2017 Organizer and Chair, “Academic Session” NDT in Canada 2017, Canter des Congres de Quebec, Quebec City, PQ, June 6 - 8 2017.
- 2017 International Organizing committee of the 21<sup>st</sup> European Conference on Thermophysical Properties (ECTP21), Graz, Austria, Sept. 3 – 8, 2017.
- 2017 Organizer and Chair, Session on Biothermophotonics and IR Bioimaging in Conference/workshop: Advanced Infrared Technology and Applications, AITA 2017 (<http://aita2017.gel.ulaval.ca/home/>), Sept. 27 – 29, Laval University, Quebec City, Canada
- 2017 Organizer and Chair, 2 Special Academic Sessions, NDT in Canada 2017, hosted by CINDE, Quebec City, June 7-8, 2017.
- 2017 – 18 Member of Organizing Committee, 20th NIST/ASME Symposium of Thermophysical Properties, June 24-29, 2018 Boulder, CO (Organized by the NIST) and Session Coordinator: Photothermal and Photoacoustic Techniques; Thermophysical Methods for Biomaterials and Biosystems, (with J. J. Alvarado-Gil); Inverse Problems and Non-Destructive Evaluation (with X. Maddague and R. Li Voti).
- 2018 Session Chair, 20<sup>th</sup> NIST/ASME Symposium of Thermophysical Properties, June 24-29, 2018 Boulder, CO. Sessions on Photothermal and Photoacoustic Techniques; Thermophysical Methods for Biomaterials and Biosystems; Inverse Problems and Non-Destructive Evaluation (with R. Li Voti).
- 2018 Session Chair, Ultrasonics 2018; III international conference on ultrasonic based applications, Caparica, Portugal, June 11-14, 2018.
- 2018 Director (with Professor Roberto Li Voti, co-director) of International School of Quantum Electronics - Progress in Photoacoustic and Photothermal Phenomena: Focus on BIOMEDICAL and NANOSCALE IMAGING and NDE”, Center Ettore Majorana in Erice (Sicily, Italy), September 6-12, 2018. Multiple session chair and student poster coordinator.
- 2018-19 Program Committee, Photons Plus Ultrasound: Imaging and Sensing 2019, Conf. 10878 SPIE BiOS 2019, San Francisco, CA
- 2018-19 Member of Scientific International Committee, 20th International Conference on Photoacoustic and Photothermal Phenomena (ICPPP20); Moscow, Russia. July 7-12, 2019
- 2018-19 Program Committee, 20th International Conference on Photoacoustic and Photothermal Phenomena (ICPPP20) International Summer School Photothermal and Photoacoustic Techniques: Theory, Instrumentation, and Applications July 6, 2019 Chemistry Department, Lomonosov Moscow State University, Moscow, Russia
- 2019 Session Chair, 20th International Conference on Photoacoustic and Photothermal Phenomena (ICPPP20); Moscow, Russia. July 7-12, 2019. Plenary Session A5, July 9, 2019; Session C2: Applied Chemistry, July 10, 2019; IPPA Awards Sessions S2 and S3, July 11, 2019.

## **XV. SERVICE: UNIVERSITY, PROVINCIAL, FEDERAL (CANADA) AND INTERNATIONAL**



**2001 – 03**

1. MIE Laser Safety Committee
2. UTMIE Graduate Studies Committee
3. UTMIE Engineering Library Liaison

**2002 - 08**

1. Research Leave Grant Committee
2. Proposal reviewer for Ukraine, Cyprus and NSF.

**2004 - 05**

1. Member of NSERC Grant Selection Committee (GSC) 29 (General Physics) (Discovery Grants; and Research Tools and Instruments), 2004 - 2007.
2. NSERC GSC 28 (Condensed Matter) Member (Research Tools and Instruments) 2004 - 2007.
3. Member of the Council, Canadian Association of Physicists; Organizing Committee of the 2005 Canadian Association of Physicists Congress, University of British Columbia, Vancouver, BC.

**2005 – 06**

1. Academic Appointments Committee
2. Coordinated effort to spearhead research activities in MIE; supervised microfluidics labs; initiated and supervises a new research project with post-doc salary funded by Dept.
3. Decanal Representative, FASE, Tenure Committee of Prof. Mohammad Mojahedi (ECE); April 06
4. Decanal Representative, FASE, Tenure Committee of Prof. Teng Joon Lim (ECE); May 06
5. Two Tenure Committees (University of Windsor, Dept. of Physics; Jordan University of Science and Technology, Irbid, Jordan)

**2006 - 07**

1. MIE Chalmers Chairs Committee
2. NSERC Review and Site Visit Committee of the Institute for Quantum Computing, Waterloo, ON, Sept. 8, 2006
3. NSERC Review and Site Visit Committee of NSERC/iCORE/GDC Industrial Research Chair in Quantum Cryptography and Communication”, Institute for Quantum Information Science, Univ. of Calgary, AB, Jan. 30, 2007
4. NSERC Workshops on Discovery Award applications for new applicants: 1) at CAP Congress, Brock University, June 14, 2006; 2) at Photonics North, Quebec City, June 7, 2006; 3) at UofT Scarborough, Sept. 20, 2006.
5. Academic Appointments Committee

**2007 - 08**

1. Reading Committee, Prof. F. Ben Amara, MIE Univ. of Toronto.
2. Engineering Science Program Review Committee
3. Academic Appointments Committee

**2008 - 09**

1. Invited reviewer by Austrian Science Foundation: “K-Project - Non Destructive Testing for critical Defect Analysis in Materials”, ZPT for the COMET Programme (Competence Centres for Excellent Technologies)
2. Review Committee, Small Equipment Grants Program, Alberta Advanced Education and Technology, Z. Hashisho: “Infrastructure for the air quality characterization and control research laboratory”
3. Member of the University of Toronto’s VP Research Review College: Assessed large UT proposals to 1) the CFI Leading Edge and New Initiatives Fund competition; and 2) Canada Excellence Research Chairs.
4. Ontario Ministry of Colleges and Universities, 2009-10 Ontario Graduate Scholarship (OGS) Selection Panel member.
5. Reading Committee, Prof. Yu Sun, MIE Univ. of Toronto.
6. Engineering Science Program Review Committee
7. NSERC Discovery and I2I Grant proposal reviewer
8. NSERC Discovery Grant Appeals Committee (2009 - )
9. Academic Appointments Committee

## Andreas MANDELIS CV

### 2009 - 10

1. Academic Appointments Committee
2. Member of the University of Toronto's VP Research Review College: Assessed large UT proposals to 1) the CFI Leading Edge and New Initiatives Fund competition; and 2) Canada Excellence Research Chairs.
3. Engineering Science Program Review Committee
4. NSERC Discovery Grant Appeals Committee (2009 - )
5. National and international research proposal reviewer for numerous institutions.
6. NSERC Collaborative Health Research Projects Selection Panel member (2010 – 2012, 2013-14)

### 2010 - 11

1. Chalmers Chair Committee
2. Discussion leading and follow-up committee for the Mechanical Engineering side of DRDC-UT/MIE Research Collaboration Workshop Day, November 17, 2010
3. Engineering Science Program Review Committee
4. Member of the University of Toronto's VP Research Review College: Assessed large UT proposals to 1) the CFI Leading Edge and New Initiatives Fund competition; and 2) Canada Excellence Research Chairs.
5. High-School Arts and Sciences Mentorship Program participant – final year
6. NSERC Discovery Grant Appeals Committee (2009 - )
7. NSERC – CIHR CHRP (Collaborative Health Research Projects) Panel (CHRP 360) (2010 – 2011)
8. NSERC Research Partnerships Program Committee (Reviewed Quantum Cryptography Research Chair, Univ. of Calgary).
9. ASME K7 Committee on Thermophysics

### 2011 - 12

1. NSERC Discovery Grant Appeals Committee (Summer 2009 - )
2. NSERC – CIHR CHRP (Collaborative Health Research Projects) Panel (CHRP 360) (2011 – 2012)
3. ASME K7 Committee on Thermophysics
4. Austria: COMET Program K-Project for Non-destructive Testing and Tomography. Midterm review site visit, February 2012. Dr. Mandelis acted as the external assessor of the Consortium.
5. US Dept. of Energy, Office of Science Financial Assistance Program commissioned the review and report of SBIR Projects.
6. NSERC Discovery Grant Appeals Committee (2009 - )
7. Tenure Committee, Professor Axel Guenther, MIE Univ. of Toronto.

### 2012 - 13

1. NSERC Discovery Grant Appeals Committee (2009 - )

### 2013 - 14

1. NSERC – CIHR CHRP (Collaborative Health Research Projects) Panel .
2. Academic Salaries Review Committee, MIE
3. China: Research Program Development consultant and 1000 Talent Award holder, University of Electronic Science and Technology of China (UESTC), Chengdu, Sichuan.

### 2014 - 15

1. Academic Salaries Review Committee, MIE
2. China: Research Program Development consultant and 1000 Talent Award holder, University of Electronic Science and Technology of China (UESTC), Chengdu, Sichuan.

### 2016- 17

1. Laser safety committee, UofT
2. PhD exam chair, M. Al Borno, Computer Science (November 10, 2016)
3. China: Research Program Development consultant and 1000 Talent Award holder, University of Electronic Science and Technology of China (UESTC), Chengdu, Sichuan.
4. CIHR College of Reviewers, member since November 8, 2017

### 2017-18

1. Laser safety committee, UofT
2. CIHR College of Reviewers, member since November 8, 2017

**2018-19**

1. Laser safety committee, UofT
2. CIHR College of Reviewers, member since November 8, 2017
3. MIE Graduate Studies Committee

**XVI. INDUSTRIAL AND HEALTH SECTOR ENTREPRENEURIAL ACTIVITIES**

1) *Founder, Chairman, President and CTO of Photo-Thermal Diagnostics (PTD), Inc.*, Toronto, ON. The company was founded in 2001 as a UofT spin-off semiconductor metrology company through venture capital investment of \$1.27 Million (Triax, Covington Capital) following a successful UofT Excellerator Business Plan competition in which PTD, Inc., won 2<sup>nd</sup> place. The Company's intellectual property was based on a decade of developments in Laser Infrared Photothermal Radiometry of electronic materials and the 2003 introduction of Photo-Carrier Radiometry at the UofT as a new diagnostic technology for semiconductor material and device optoelectronic quality. Currently, PTD has transitioned to a new spin-off company, Diffusion-Wave Diagnostic Technologies, of Toronto, ON, (see item # 3 below).

2) *Co-founder and CTO of Quantum Dental Technologies (QDT), Inc.*, Toronto, ON ([www.thecanarysystem.com](http://www.thecanarysystem.com)). The company was founded as a UofT spin-off in February 2007 in partnership with Dr. Stephen Abrams, DDS, as the CEO and Dr. A. Mandelis as the President and CTO. The Company's intellectual property is based on 10 years of development of Laser Photothermal Radiometry and Modulated Luminescence (PTR-LUM) tooth inspection technique at the UofT as a combined early demineralization caries diagnostic technology with the ability to detect incipient caries before dental x-rays can, both occlusally and interproximally. The company tied for 1st place (and received \$6,500 award) at a Business Plan competition sponsored by the Schulich School of Business, York University, Toronto, ON and by Sanofi Pasteur Healthcare & Biotechnology Venture Challenge (November 8, 2007). The Company has been licensed to market clinical dentistry products in Canada (Health Canada), the EU, and the US (FDA 510(k)). It currently markets the "Canary<sup>TM</sup> Early Caries Detection System".

3) *Founder and CEO, Scarborough Science Associates*, Toronto, ON. The company acts as a consultant to, and produces monthly New Products reports for, the American Institute of Physics for their international flagship magazine "Physics Today" and for the research journal "Review of Scientific Instruments". Andreas Mandelis is the New Products Editor for these publications.

4) *Founder and President, Diffusion-Wave Diagnostic Technologies, Inc.*, ([www.diffusewavetech.com](http://www.diffusewavetech.com)) Toronto, ON. This company was established in 2009 with a mandate to commercialize promising instrumentation technologies as they are being developed in the Center for Advanced Diffusion-Wave Technologies, University of Toronto. Current foci: Industrial steel hardness case depth NDT; Solar cell optoelectronic NDT and imaging; and thermophotonic imaging.

**XVII. BIOGRAPHICAL INFORMATION**

**Andreas Mandelis** is a Full Professor of Mechanical and Industrial Engineering; Electrical and Computer Engineering; and the Institute of Biomaterials and Biomedical Engineering, University of Toronto. He has been the Chairman, and CTO of Photo-Thermal Diagnostics, Inc., Toronto, ON, Canada. He is the President and CTO of Diffusion-Wave Diagnostic Technologies, Inc., Toronto, ON ([www.diffusewavetech.com](http://www.diffusewavetech.com)), and the CTO of Quantum Dental Technologies, Inc., Toronto, ON, Canada ([www.thecanarysystem.com](http://www.thecanarysystem.com)). He was born in Kerkyra (Corfu), Greece. He received his BS degree (Magna cum Laude) in physics from Yale University in 1974, and MA, MSE, and Ph.D. degrees from the Applied Physics and Materials Laboratory, Department of

Mechanical and Aerospace Engineering, Princeton University. He joined the electronics industry in the silicon Process R&D as a Member of Scientific Staff, Bell Northern Research Labs, Ottawa, in 1980-1981. He is the Director of the Center for Advanced Diffusion-Wave and Photoacoustic Technologies (CADIPT) at the University of Toronto. He is the author and co-author of more than 415 scientific papers in refereed journals and of 190 scientific and technical proceedings papers; he is the author of the book *Diffusion-Wave Fields: Mathematical Methods and Green Functions*, published by Springer-Verlag (2001) and the co-author of the book *Physics, Chemistry and Technology of Solid State Gas Sensor Devices* published by Academic Press (1993). He is Editor-in-Chief of the Springer *International Journal of Thermophysics*, an Associate Editor of the AIP Journals *Review of Scientific Instruments* and *Journal of Applied Physics*, and Editorial Board Member of the SPIE *Journal of Biomedical Optics* and the (on-line journal) *Diffusion Fundamentals*. He has been Editor-in-Chief of the book series "Progress in Photothermal and Photoacoustic Science and Technology", published by the Society for Optical Engineering (SPIE). He has also been Topical Editor of the OSA journal *Optics Letters*, on the editorial or advisory boards of *Applied Physics Letters*, *NDT&E International*, *Journal of Analytical Sciences (J. Chem. Soc. Japan)*, and a guest editor of a number of special issues in the area of photoacoustic/photothermal and generally, diffusion-wave phenomena. He is Consulting Editor – New Products of the AIP flagship magazine *Physics Today*. He has several inventions, 38 patents and patents pending in the area of photothermal tomographic imaging, signal processing and measurement, hydrogen sensors, dental laser diagnostics (biothermophotonics), semiconductor laser infrared photothermal radiometry, laser photo-carrier radiometry and laser biophotoacoustic tissue imaging.

He is a Fellow of the American Physical Society, a Fellow of the Society for Optical Engineering (SPIE), of the American Association for the Advancement of Science (AAAS), of the ASME and of the ASME K7 Committee on Thermophysics. He has been on the Executive and Leadership of the APS Instrument and Measurement Science Topical Group and is the Founder and Chair of the Division of Instrumentation and Measurement Physics (DIMP) of the Canadian Association of Physicists (CAP). He is the Co-founder and President of the International Photoacoustic and Photothermal Association (IPPA), a scientific prize awarding society with headquarters in Toronto, CA, and Providence, USA. In 2002 he was awarded the Alexander von Humboldt Award (Germany) "*in recognition of his past accomplishments in research and teaching*". He has been awarded A. von Humboldt Visiting Professorships twice more (in 2012-13 and 2017-18) since the original award. In 2004 he was the recipient of the New Pioneers Award in Science and Technology of Skills for Change (City of Toronto) and in 2007 he was selected among the New Pioneers for a special 15<sup>th</sup> anniversary awards celebration.

In 2006 he was elected Fellow in the Academy of Sciences of The Royal Society of Canada. The brief citation reads: "*Andreas Mandelis is an internationally renowned expert in the development, shaping and applications of diffusion-wave sciences and associated technologies. He pioneered and developed numerous techniques and devices that are now used worldwide for materials research, industrial process quality control, dental caries diagnosis and soft tissue imaging*". In April 2007 he became the 2007 (inaugural) recipient of the Discovery Award in Science and Engineering (the Ontario Premier's Innovation Award). In 2008 he was awarded a Canada Research Chair (Tier 1) in Diffusion-Wave Sciences and Technologies. In the same year he became the recipient of the ASME 2009 Yeram Touloukian Award (and Medal) in Thermophysics. In 2009 he was awarded the Senior Prize of the International Photoacoustic and Photothermal Association and the Canadian Association of Physicists (CAP) Medal for Outstanding Achievement in Industrial and Applied Physics. In 2010 he was awarded a Killam Research Fellowship from the Canada Council for the Arts. He is the recipient of the American Physical Society's 2012 Joseph F. Keithley Award for Advances in Measurement Science. The brief citation reads: "*For seminal contributions to the development of new experimental techniques based on photothermal science, and the application of these techniques to a variety of real-world problems.*" In April 2012 he was selected as the recipient of the Canadian Association of Physicists – Institut National d'Optique (CAP-INO) Medal for Outstanding Achievement in Applied Photonics. The brief citation reads: "*for his seminal contributions to the field of photothermal and photoacoustic science and applications*". In 2013 he was selected as one of 10 recipients of the 2013 University of Toronto Inventors of the Year Award and he was elected Fellow of the Canadian Academy of Engineering. In 2014 he was elected Killam laureate,

recipient of the Killam Prize in Engineering, one of Canada's highest academic prizes awarded annually by the Governor General of Canada on behalf of the Killam Foundation and the Canada Council of the Arts.

***Research Interests.***

Andreas Mandelis' *theoretical research interests* are focused on studies of physical energy conversion processes in condensed and biological matter as they impact instrumentation science and signal generation technologies. Core areas are thermophysics, optoelectronics, photovoltaics, photoacoustic, photothermal and general diffusion-wave phenomena in engineering, electronic, biological and photonic media. Current interests include building theoretical and experimental foundations of thermophysical, biothermophotonic and biophotoacoustic transport phenomena, high-performance diagnostic imaging techniques and advanced signal generation and processing methods ("waveform engineering") for semiconductors, photovoltaic solar cells, hard (dental, bone) and soft tissues, novel biosensors, and defect inspection in industrial materials.

Aligned with his theoretical activities, his *applied research interests* span the development of a wide spectrum of novel instrumentation, measurement and imaging science techniques, using energy conversion high-dynamic-range and high-sensitivity analytical methodologies, leading to advanced non-destructive / non-invasive diagnostic, inspection and monitoring technologies. Current application examples are in the fields of alternative clean energy conversion devices (e.g. solar cells, nano-optoelectronic devices), industrial manufactured products (steels, metal composites, nano-coatings), biomedical and dental disease diagnostics and thermophysical inverse problems in industrial materials, with major focus on advanced dynamic imaging instrumentation.