

Robert L. Opila

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2008 – 2009, Interim Chair, Dept. Materials Science and Eng., University of Delaware
2002 – present, Professor, Dept. Materials Sci. and Eng., University of Delaware

Research interests include molecular electronics, role of interfaces in organic light emitting diodes and photovoltaics, thin oxide films, semiconductor surface processing, and high-k and low-k dielectric materials. Performance of materials and interfaces are probed with electron spectroscopies.

1982 - 2001, Bell Labs, Lucent Technologies, Murray Hill, NJ 07974

1995 - 2001, Technical Manager, Surface Preparation and Interface Reliability Group

- Managing group whose responsibilities include
 - control of silicon surface/solution interfaces during chemical cleaning.
 - use of radio-isotopes to study mechanism of metallic contamination.
 - improved understanding of corrosion of metallization.
 - reliability of electronic devices as limited by material interfaces.
- Led research into
 - interfaces between low dielectric constant insulators and metals, demonstrating importance of interface reactivity on metal diffusion, interface morphology, and stability
 - composition, and chemical and electrical defects in high dielectric constant materials.

1993 - 2001, Distinguished Member of Technical Staff

- Developed synchrotron radiation as nondestructive probe of reactions at metal/polymer interfaces.
- Elucidated role of polymer surface and processing in metal adhesion to polymers.
- Established self-assembled monolayers as ideal model for metal/polymer reaction studies.

1982 - 1993, Member of Technical Staff

- Determined simultaneously compositional and electrical properties of photodiodes with sub-micron spatial resolution using Auger electron spectroscopy.
- Utilized fundamental studies of metal/polymer interfaces to develop a novel anisotropic conduction medium, elucidated new failure mechanism in conductive metal/polymer composites, and improved understanding of adhesion and reliability in multilayer printed wiring boards and advanced VLSI packaging applications.
- Consulted within Bell Labs on more than 50 problems/year concerning complex surface and interfacial phenomena related to electronic device or package reliability.

Professional Activities:

National Societies:

- Editor, Applied Surface Science

- Editorial Board of Journal of Vacuum Science and Technology
- Organized 1st International Conference on Applied Surface Science, Shanghai, 28 July – 31 July, 2015
- Organized Materials Research Science Symposia Symposia, Polymer/Inorganic Interfaces, Spring 93, Spring 95
- Organized Electrochemical Society Symposium, Metallized Plastics, Spring 96, Chemical-Mechanical Planarization, Spring 98, Fall 99, Fall 00.
- Organized American Physical Society Symposium, High Dielectric Constant Materials, 2000.
- Organized AIChE symposia on Chemical Mechanic Planarization, 2003, 2004
- Electrochemical Society, New Technology Committee; Chair, Individual Membership; Chair, Dielectric Science and Technology Committees.
- American Vacuum Society, Applied Surface Science Division, Member at Large, 1997 – present, chair of ASSD Division, 2000, chair of EMPD Division, 2008-2009
- ASTM Committee on Surface Science, chair of Terminology Sub-committee, secretariat for ISO Surface Analysis
- Chaired RFP for US Display Consortium on wet chemical processing.

Educational:

- SRC Mentor for Lehigh University, University of Texas, Stanford University.
- Mentored 12 undergraduate summer research students.
- Mentored seven post-doctoral associates.

Academic:

- President, Faculty Senate 2015-2016
- College Promotion and Tenure 2003-2005, 2013 - present MSE P&T, 2006-07
- Chair, MSE Faculty Search Committee 2002-2003, 2005-06, 2007-08, 2010-11
- Chair, Department Graduate Student Admissions and Advising 2002-2008
- Chair, Seminar Committee, 2002-2005
- Faculty Senate, 2002 – 2008, Committee on Committee Nominations, 2005 - 2008
- University Recycling Committee 2004- 2005
- University Graduate Studies Committee, 2005-2008, Chair 2008 – 2010
- University of Delaware Energy Institute, 2008 - present

Education:

1982 Ph.D., Chemistry, The University of Chicago, Chicago, IL. Investigated the adsorption of xenon, krypton, oxygen, and carbon monoxide on the (110) plane of tungsten. Advisor: R. Gomer.
 1977 M. S., Chemistry, The University of Chicago, Chicago, IL.
 1975 B. S., Chemistry, The University of Illinois, Urbana, IL.

Honors:

Fulbright Scholar, (2012-2013).
 Visiting Professor, School of Photovoltaics and Renewable Energy, UNSW, Sydney (2013)
 Fellow, American Vacuum Society (2000).
 Promoted to Technical Manager (1995).
 Distinguished Member of Technical Staff (1993).
 Divisional Affirmative Action Award (1993).
 Prize Paper Award, 34th IEEE Holm Conference (1989).
 James Franck Scholar, The University of Chicago (1975-1977).

B. S. Awarded with Highest Departmental Distinction (1975).
Edmund James Scholar, University of Illinois (1971-1975).

Presentations:

Presentations at more than 60 universities and conferences including invited talks at Gordon conferences, national and international meetings.

International Talks and Conferences

Conferences Organized

1. 13th European Conference on Applications of Surface and Interface Analysis, ECASIA'09, Antalya, Turkey, 18-23 October 2009, Scientific Program Committee.
2. 1st International Conference on Applied Surface Science (ICASS), Shanghai China, 27-30 July 2015, organizing committee; contributed "Adaption of statistical analysis to variable kinetic energy x-ray photoemission spectroscopy for computational depth profiles," by J. Church, R. L. Opila, and C. Weiland.
3. 30th European Conference on Surface Science, Antalya, Turkey, organizing committee, 31 August – 5 September 2014.

Talks

1. First International Congress On Adhesion Science And Technology, Invited paper, "X-ray absorption spectroscopy at buried metal/ polymer interfaces" R.L. Opila, K. Konstadinidis, M.A. Marcus and M. Du, Amsterdam, NL Oct 26 1995
2. 5th International Symposium on Ultraclean Processing of Silicon Surfaces (UCPSS), Ostend, BE, 19 Sept. 2000, contributed, "Evolution of Chemical Oxides into Ultrathin Oxides: A Spectroscopic Characterization," J. Eng, R. Opila, J. M. Rosamilia, B. J. Sapjeta, Y. J. Chabal, T. Boone, and R. Masaitis.
3. Workshop on Surface Science – Porto Alegre, Brazil, March 20-22, 2003, "Photoelectron Spectroscopy Investigation of High- κ Dielectrics," Robert L. Opila.
4. International Conference on Surfaces, Materials, and Vacuum 2010, Keynote Address, "Role of Surfaces and Surface Analysis in Photovoltaics," Cancun, Mexico, 27 September, 2010. Sociedad Mexicana di Cienca y Tecnologia de Superices y Materiales.
5. Koç Üniversitesi, Department of Chemistry seminar, 22 November 2012; Bilkent University, Chemistry Department, 18 January 2013; "Role of Surface Chemistry in Photovoltaics" R. L. Opila, F. Fang, L. L. Costello, B. E. McCandless, D. Yang, A. Teplyakov, F. Tian.
6. 10th Kimyasal Fizik Kongresi, Ankara, Turkey 12 October 2012 and 3rd Pakistan-Turkey Chemistry Conference, Bursa, Turkey, 14 September 2012 (both invited), "Silicon/Organic

Interfaces: Role of Surface Defects and Their Minimization in Photovoltaics,” R. L. Opila, Dan Yang, L. L. Costello, N. Kotulak, F. Tian, A. Teplyakov.

7. University of New South Wales, Sydney, AU, School of Photovoltaics and Renewable Energy Engineering Seminar, “Role of Surfaces and Their Analysis in Photovoltaics,” 23 March 2013.

Courses Taught

- MSEG 804, Spring 2002, Spring 2004, Spring 2006, Spring 2008, Spring 2010, Spring 2011, Spring 2012, Spring 2014, Spring 2015, Spring 2016
Kinetics, **Chemical Kinetics and Dynamics**, Steinfeld, Francisco, and Hase
Chemical Kinetics, Diffusion, Rate of Phase Transitions
- MSEG 607, Fall 2002, Fall 2004, Fall 2006, Properties of Materials
Solid State Physics, Kittel, **Solid State Physics**, Ashcroft and Merman
Crystalline structure, phonons, electronic structure
- MSEG 841, Fall 2013, Fall 2014, Fall 2015, Fall 2015
Solid State Physics, Kittel, **Solid State Physics**, Ashcroft and Merman
Crystalline structure, phonons, electronic structure
- MSEG 302, Spring 2003, Spring 2005, Spring 2007, Introduction to Materials Science
Materials Science and Engineering: An Introduction, Callinan
Structure of materials, kinetic, thermodynamic, structural properties
- MSEG 667, Fall 2003, Special Topics in Materials Science, Electronic Materials
Silicon VLSI Technology: Fundamentals, Practice and Modeling, Plummer, Deal, and Griffin,
Silicon-based integrated circuit materials and processing, optical fibers,
Compound semiconductors including lasers and detectors
- MSEG 667, Fall 2004, Fall 2005, Special Topics in Materials Science, Nanoelectronics
Nanoelectronics and Information Technology, Waser, ed.
Quantum mechanics, next generation Si, organic and magnetic devices, interface with biology
- MSEG 667, Fall 2004, Special Topics in Materials Science, Fall Seminar Series
- MSEG 667, Fall 2007, Energy Sustainability
- MSEG 667, Spring 2009, Spring 2011, Topics in Renewable Energy
- MSEG 608, Fall 2010, Fall 2012, Properties of Materials

Students

Korhan Demirkan	PhD	Interfaces between Organic Films and Electrodes for OLEDs (graduated 6/2008)
Ernest Addo	PhD	Screen-Printable Doped Self-Aligned Metallization for Solar Cell Fabrication (graduated 6/2004)
Anoop Mathew	PhD	Thin Oxide Films for Magnetic Tunnel Junctions (graduated 6/2008)
Lijie Bao	PhD	(La ₂ O ₃) _x (Al ₂ O ₃) _{1-x} Films for High-k Dielectrics (graduated 6/2010)
Conan Weiland	PhD	Molecular Electronics on Si(111) (graduated 6/2010)
Clifford Yapp	MS	Growth of CuIn _x Ga _{1-x} (S _y Se _{1-y}) ₂ for Photovoltaic Applications (graduated spring 2006)

Tiffany Denny	MS	Nanofabrication of ZnO (graduated MS, spring 2006)
Beverly Wright	PhD	Nanofabrication of ZnO (graduated 5/2011)
Michael Burrows	PhD	Role of H in Si-based Photovoltaics (graduated 6/2009)
Sarah Rickman	MS	Growth of $\text{CuIn}_x\text{Ga}_{1-x}(\text{S}_y\text{Se}_{1-y})_2$ for Photovoltaic Applications (graduated MS, spring 2006)
Fang Fang	PhD	Energy Band Alignment in Renewable Energy (graduated 7/2011)
Susan Huang	PhD	Liquid phase epitaxy for Photovoltaic Applications (graduated 10/2011)
Bhumika Chhabra	PhD	Passivation for high efficiency solar cells (graduated 8/2010)
Balakrishnam Jampana	PhD	GaN Solar Cells (graduated 8/2010)
Dan Yang	PhD	Low-k Materials for Integrated Circuits (graduated, August 2013)
Jonathon Church	PhD	Inverse Photoemission (graduated July 2015)
Luke Costello	MS	Surface Passivation for Photovoltaics (graduated August 2013)
Kevin Jones	PhD	Band Alignment in (Ag, Cu)(Ga, In)(S, Se) Solar Cells
Ken Schmeider	PhD	GaAsP/SiGe Tandem Solar Cells (graduated February 2013)
Nicole Kotulak	PhD	Induced Junction Solar Cells (graduated August 2014)
James Krajewski	PhD	Metal/polymer interfaces for organic electronics (will graduate 2016)
Xi Lin	PhD	Atomic Layer Etching
Bo Yuan	PhD	Light Trapping for Tandem PV
Meixi Chen	PhD	Organic Passivation and Induced Junctions in Silicon Photovoltaics
Glenn Catlin	PhD	Mechanics of Porous Low-k Materials for Integrated Circuits
Jimmy Hack	PhD	Hybrid Organic/Si Solar Cells
Moses Haimbodi	post-doc	
Guangming Liu	post-doc	MBE of GaSb Quantum Dots

Grants

1. "Zinc Oxide Nanoelectronics," ARO, with Olufemi Olowolafe, \$46,900, 10/01/06-5/30/06
2. "International Opportunities for Scientists and Engineers," NSF, \$2000, 06/01/03-05/31/04
3. "Charge Transfer Between Semiconducting Substrates and Organic Molecules," ACS-PRF, \$80,000, 9/01/06-08/31/08
4. "IGERT: Sustainable Energy from Solar Hydrogen," with Christiana Honsberg, \$3,100,000, 10/01/06-12/31/10
5. "Advanced Nanoscale Thin Film & Bulk Materials Toward Thermoelectric Power Conversion Efficiencies of 30%," DARPA, with RTI, \$190,284, 04/01/08-03/31/11
6. "MRI: Fabrication of an Inverse Photoemission Spectrometer," NSF, with Rutgers and Brookhaven, \$189,753, 07/01/04-6/30/07
7. "Toward 50% Efficient Solar Cells," DARPA, \$200,000, 01/01/06 – 08/30/2008
8. "DURIP Acquisition of Nano-indenter," ARO, with Anette Karlsson and Olufemi Olowolafe, \$296,775, 07/01/06-06/30/09
9. "Improved Silicon Photovoltaic Module Technology," DNREC, subcontract with GE, \$50,000, 08/01/05-07/31/07.
10. "QESST," Energy Research Center, NSF/DOE, \$23,000,000 with Christiana Honsberg, ASU.
11. "GaAsP/SiGe Tandem Solar Cells," Australian Solar Institute, \$180,000,

12. "Collaborative Research: Development of Novel Nonlinear Optical Contrast for High-Resolution Morphological and Chemical: Imaging of Historical Artwork," NSF, \$87,913 9/1/2013 - 8/31/2016
13. "Large-Area Anodic Oxides for Silicon Solar Cell Passivation," University of Delaware Energy Institute, \$25,000, 9/1/2015-8/31/2016
14. "Hybrid fluorinated materials characterization," sub Seton Hall University / Porter Scientific / DOD, \$12,000, 10/15/2015 - 10/14/2016.

Have also received support from DuPont, ASM, GE, Lucent, Air Liquide and Ubiquitous Technologies. Co-founder of 510nano.

Publications (h-index 36)

1. "Materials characterization and the evolution of materials," J. O. Boyd, R. L. Opila, I. W. Boyd, E. N. Kaufmann, *MRS Bulletin*, 40, 1019-1033 (2015) doi: 10.1557/mrs.2015.271
2. "Photoluminescence analysis of a 16.8% efficient 18 μm silicon solar cell," Lu Wang, Hongzhao Li, Chao Shen, Jianshu Han, Peinan Teng, Malcolm Abbott, Anthony Lochtefeld, Robert Opila, Allen Barnett, *International Journal of Emerging Technology and Advanced Engineering*, 5 (No 2), 8 – 14 (2015).
3. "Light Trapping in an 18 μm Silicon Solar Cell with a Current Density of 34.5 mA/cm²," Lu Wang, Jianshu Han, Jiangjia Li, Alison Lennon, Anthony Lochtefeld, Andrew Gerger, Mark Carroll, Peinan Teng, Robert Opila, Allen Barnett, *International Journal of Emerging Technology and Advanced Engineering*, 5 (No 8) 7-15, (2015).
4. "Tandem GaAsP/SiGe on Si solar cells," Martin Diaz, Li Wang, Dun Li, Xin Zhao, Brianna Conrad, Anasasia Soeriyadi, Andrew Gerger, Anthony Lochtefeld, Chris Ebert, Robert Opila, Ivan Perez-Wurfl, Allen Barnett *Solar Energy Materials and Solar Cells* 143, 113-119 (2015) doi:10.1016/j.solmat.2015.06.033
5. "GaAsP on SiGe/Si material quality improvements with in-situ stress sensor and resulting tandem device performance," Kenneth J Schmieder, Andrew Gerger, Martin Diaz, Ziggy Pulwin, Michael Curtin, Li Wang, Chris Ebert, Anthony Lochtefeld, Robert L Opila, Allen Barnett, *Materials Science in Semiconductor Processing* 139, 614-620, (2015) doi:10.1016/j.mssp.2015.05.058.
6. "Optical constants of silicon germanium films grown on silicon substrates," Dun Li, Xin Zhao, Andrew Gerger, Robert Opila, Li Wang, Brianna Conrad, Anastasia H Soeriyadi, Martin Diaz, Anthony Lochtefeld, Allen Barnett, Ivan Perez-Wurfl, *Solar Energy Materials and Solar Cells*, 140, 69-76 (2015) doi:10.1016/j.solmat.2015.03.031.
7. "Examining the free radical bonding mechanism of benzoquinone and hydroquinone—methanol passivation of silicon surfaces," Nicole A Kotulak, Meixi Chen, Nikolas Schreiber, Kevin Jones, Robert L Opila *Applied Surface Science* 354B 469-474 (2015) doi:10.1016/j.apsusc.2015.02.127
8. "Understanding the role of buried interface charges in a metal-oxide-semiconductor stack of Ti/Al₂O₃/Si using hard x-ray photoelectron spectroscopy," J. R.Church, C. Weiland, R. L. Opila, *Applied Physics Letters*, 106, 171601, (2015) DOI: 10.1063/1.4919448.
9. "Characterization of the Microstructure of GaP Films Grown on {111} Si by Liquid Phase Epitaxy," S. R. Huang, X. S. Lu, A. Barnett, R. L. Opila, V. Mogili, D. A. Tanner, S. Nakahara, *ACS Applied Materials and Interfaces*, 6, 18626-18634 (2014) DOI: 10.1021/am503448g.
10. "Development of a 16.8% Efficient 18- μm Silicon Solar Cell on Steel," L. Wang, A. Lochtefeld, J. S. Han, A. P. Gerger, M. Carroll, J. J. Ji, A. Lennon, H. Z. Li, R. Opila, A. Barnett, *IEEE Journal of Photovoltaics*, 4, 1397-1404 (2014) DOI: 10.1109/JPHOTOV.2014.2344769.
11. "Nondestructive compositional depth profiling using variable-kinetic energy hard X-ray photoelectron spectroscopy and maximum entropy regularization," C. Weiland, J. Krajewski, R. Opila, V. Pallem, C. Dussarrat, J. C. Woicik, *Surface and Interface Analysis*, 46, 4070417 (2014) DOI: 10.1002/sia.5517.
12. "Toward a tandem gallium phosphide on silicon solar cell through liquid phase epitaxy growth," N. A. Kotulak, M. Diaz, A. Barnett, R. L. Opila, *Thin Solid Films*, 556, 236-240 (2014) DOI: 10.1016/j.tsf.2014.01.073.
13. "Light-induced anodisation of silicon for solar cell passivation," J. Cui, X. Wang, R. Opila, *Journal of Applied Physics*, 114, 184101 (2013), doi /10.1063/1.4829701 [Q1; IF 2.22; Cited 0]

14. "Band-Bending at Buried SiO₂/Si Interface Probed by XPS," M. Copuroglu, J. Sezen, R. L. Opila, S. Suzer, *ACS Applied Materials and Interfaces*, **5**, 5875–5881 (2013) DOI: 10.1021/am401696e [Q1; IF 5.008; Cited 0]
15. "Quantification of trap state densities in GaAs heterostructures grown at varying rates using intensity-dependent time resolved photoluminescence," C. R. Haughn, K. J. Schmeider, J. M. O. Zide, A. Barnett, C. Ebert, R. Opila, and M. F. Doty, *Applied Physics Letters*, **102**, 182108 (2013) doi: 10.1063/1.4802841 [Q1; IF 3.794, Cited 0].
16. "The photodegradation of cadmium yellow paints in Henri Matisse's *Le Bonheur de vivre* (1905 – 1906)," J. L. Mass, R. L. Opila B. Buckley, M. Cotte, J. Church, A. Mehta, *Applied Physics A, Materials Science and Processing*, **111**, 59-68 (2013) DOI 10.1007/s00339-012-7418-0 [Q2; IF 1.545, Cited 4]
17. "Investigating Voltage as a Function of the Reduced Junction Area for Thin Silicon Solar Cells That Utilize Epitaxial Lateral Overgrowth," R. Hao, C. P. Murcia, C. Leitz, A. P. Gerger, A. Locktefeld, M. Curtin, K. Shreve, R. Opila, A. Barnett *IEEE Journal of Photovoltaics*, **111**, 59-68 (2013) DOI 10.1109/JPHOTOV.2012.2211999 [Q1 ; IF 2.356; cited 0]
18. "Design, fabrication and analysis of germanium:silicon solar cells in a mult-junction concentrator system, Y. Wang, A. P. Gerger, A. Locktefeld, L. Wang, C. Kerestes, R. Opila, A. Barnett, *Solar Energy Materials and Solar Cells*, **108**, 146-155 (2013) DOI 10.1016/j.solmat.2012.08.016 [Q1; IF 4.630; Cited 0]
19. "Development of low-k precursors for next generation IC manufacturing," Doniat, Francois; Anderson, Curtis; Dussarrat, Christian, McAndrew, James, Opila, Robert, Wright, Beverly, Yang Dan; *Microelectronics Engineering*, **92**, 34 -37 (2012). DOI: 10.1016/j.mee.2011.05.040 [Q3; IF 1.224; Cited 0]
20. "Corrosion of RoHS-Compliant Surface Finishes in Corrosive Mixed Flowing Gas Environments," Hannigan, K.; Reid, M.; Collins, M. N., Dalton, E., Xu, C., Wright, B., Demirkan, K., Opila, RL, Reents, WD, Franey, JP, Fleming DA, Punch, J; *Journal of Electronics Materials*, **41**, 611-623 (2012). DOI: 10.1007/s11664-011-1799-2 [Q2; IF 1.635; Cited 0]
21. "Chemical and Electrical Passivation of Si(111) Surfaces," Tian, Fangyuan; Yang, Dan; Opila, Robert L.; Teplyakov, Andrew; *Applied Surface Science*, **258**, 3019-3026 (2012). DOI: **10.1016/j.apsusc.2011.11.030** [Q2; IF 2.112; Cited 8]
22. "Optical absorption dependence on composition and thickness of In_xGa_{1-x}N (0.05<x<0.22) grown on GaN/sapphire," Jampana, B. R., Weiland, C. R., Opila, R. L., Ferguson, I. T. Honsberg, C. B., *Thin Solid Films*, Volume 520, Issue 22, 1 September 2012, Pages 6807-6812. [Q2; IF 1.604; Cited 2]
23. "Binding of styrene on silicon (111)-7 × 7 surfaces as a model molecular electronics system," Weiland, C. R., Yang, L., Doren, D. J., Menning, C. A., Skliar, D., Willis, B. G., Chen, J. G., Opila, R. L., *Journal of Vacuum Science and Technology A: Vacuum, Surfaces and Films*, Volume 30, Issue 3, May 2012, Article number 031401. [Q3; IF 1.267; Cited 0]
24. "Surface characterization of quinuhydrone-methanol and iodine-methanol passivated silicon substrates using x-ray photoelectron spectroscopy," Chhabra, Bhumika; Weiland, Conan; Opila, Robert L.; Honsberg, Christiana B., *Physica Status Solidi A: Applications and Materials Science* (2011), **208**(1), 86-90. [Q2; 1.469; Cited 3]
25. "Preparation of clean Bi₂Te₃ and Sb₂Te₃ thin films to determine alignment at valence band maxima," Fang, Fang; Opila, Robert L.; Venkatasubramanian, Rama; Colpitts, Thomas, *Journal of Vacuum Science & Technology, A: Vacuum, Surfaces, and Films* (2011), **29**(3), 031403/1-031403/5. [Q2; IF 1.432; Cited 4]
26. "Use of Sb spray for improved performance of InAs/GaAs quantum dots for novel photovoltaic structures," Bremner, Stephen P.; Nataraj, Latha; Cloutier, Sylvain G.; Weiland, Conan; Pancholi, Anup; Opila, Robert *Solar Energy Materials & Solar Cells* (2011), **95**(7), 1665-1670. [Q1; IF 4.630; Cited 3]
27. "Wet Etching and Surface Analysis of Chemically Treated InGaN Films," Karar, N.; Opila, R.; Beebe, T. *Journal of the Electrochemical Society* (2011), **158**(6), D342-D350. [Q2; IF 2.588; Cited 2]
28. "Scanning Tunneling Microscopy and X-ray Photoelectron Spectroscopy Studies of Graphene Films Prepared by Sonication-Assisted Dispersion," Polyakova, Elena Y.; Rim, Kwang-Taeg; Eom, Dae-Jin; Douglass, Keith; Opila, Robert L.; Heinz, Tony F.; Teplyakov, Andrew V.; Flynn, George W., *ACS Nano*, **5**, 6102-6108 (2011). [Q1; IF 12.062; Cited 5]
29. Corrosion of Cu under highly corrosive environments Demirkan, K.; Derkits, G. E., Jr.; Fleming, D. A.; Franey, J. P.; Hannigan, K.; Opila, R. L.; Punch, J.; Reents, W. D., Jr.; Reid, M.; Wright, B.; Xu, C; *Journal of the Electrochemical Society* (2010), **157**(1), C30-C35. doi: 10.1149/1.3258288 [Q2; IF 2.588; Cited 5]
30. "Conduction mechanism of sputtered BaTiO₃ film on Ni substrate," Bao, Lijie; Ryley, James; Li, Zhigang; Wilker, Charles; Zhang, Lei; Reardon, Damien; Opila, Robert, *Journal of Applied Physics* (2009), **106**(11), 114114/1-114114/4. [Q1; IF 2.22; Cited 8]

31. "Design and realization of wide-band-gap (~ 2.67 eV) InGaN p-n junction solar cell," Jampana, Balakrishnam R.; Melton, Andrew G.; Jamil, Muhammad; Faleev, Nikolai N.; Opila, Robert L.; Ferguson, Ian T.; Honsberg, Christiana B., *IEEE Electron Device Letters* (2010), 31(1), 32-34. [Q1; IF 2.789; Cited 25]
32. "High effective minority carrier lifetime on silicon substrates using quinhydrone-methanol passivation," Chhabra, Bhumika; Bowden, Stuart; Opila, Robert L.; Honsberg, Christiana B. *Applied Physics Letters* (2010), 96(6), 063502/1-063502/3 [Q1; IF 3.794, Cited 11].
33. "Promising Thermoelectric Properties of Commercial PEDOT-PSS Materials and Their Be₂Te₃ Powder Composites, Zhang, B.; Sun, J.; Katz, H. E.; Fang, F.; Opila, R. L. *ACS Applied Materials & Interfaces* (2010), 2(11), 3170-3178. [Q1; IF 5.008; Cited 50]
34. "Surface cleaning procedures for thin films of indium gallium nitride grown on sapphire," Douglass, K.; Hunt, S.; Teplyakov, A.; Opila, R. L., *Applied Surface Science* (2010), 257(5), 1469-1472. [Q2; IF 2.112; Cited 2]
35. "Comparison of the sputter rates of oxide films relative to the sputter rate of SiO₂," Baer, D. R.; Engelhard, M. H.; Lea, A. S.; Nachimuthu, P.; Droubay, T. C.; Kim, J.; Lee, B.; Mathews, C.; Opila, R. L.; Saraf, L. V.; et al. *Journal of Vacuum Science & Technology, A: Vacuum, Surfaces, and Films* (2010), 28(5), 1060-1072. [Q2; IF 1.432; Cited 18]
36. "Understanding tunnel magnetoresistance during thermal annealing in MgO-based junctions with CoFeB electrodes," Wang, W. G.; Ni, C.; Miao, G. X.; Weiland, C.; Shah, L. R.; Fan, X.; Parson, P.; Jordan-Sweet, J.; Kou, X. M.; Zhang, Y. P.; et al *Physical Review B: Condensed Matter and Materials Physics* (2010), 81(14), 144406/1-144406/6. [Q1; IF 3.767; Cited 15]
37. "Effects of boron and phosphorus doping on the photoluminescence of self-assembled germanium quantum dots," Sustersic, N., Nataraj, L., Weiland, C., Coppinger, M., Shaleev, M. V., Novikov, A. V., Opila, R., Cloutier, S.G., Kolodzey, J., *Applied Physics Letters*, Volume 94, 2009, Article number 183103. [Q1; IF 3.794, Cited 4]
38. "Reactions of aromatic bifunctional molecules on silicon surfaces: nitrosobenzene and nitrobenzene," Perrine, K. A., Leftwich, T. R., Weiland, C. R., Madachik, M. R., Opila, R. L. Teplyakov, A. V., *Journal of Physical Chemistry C*, Volume 113, 2009, pages 6643-6653. [Q1; IF 4.814; Cited 14]
39. "Correlation of crystalline defects with photoluminescence of InGaN layers," Faleev, N., Jampana, B., Jani, O., Yu, H. Opila, R. Ferguson, I. Honsberg, C., *Applied Physics Letters*, Volume 95, Issue 5, 2009, Article number 051915, DOI: 10.1063/1.3202409 [Q1; IF 3.794, Cited 13]
40. "Report on the 47th IUVSTA Workshop 'Angle-Resolved XPS: the current status and future prospects for angle-resolved XPS of nano and subnano films'," A. Herrera-Gomez, J. T. Grant, P. J. Cumpson, M. Jenko, F. S. Aguirre-Tostado, C. R. Brundle, T. Conard, G. Conti, C. S. Fadley, J. Fulghum, K. Kobayashi, L. Kóv' er, H. Nohira, R. L. Opila, S. Oswald, R. W. Paynter, R. M. Wallace, W. S. M. Werner and J. Wolstenholmer, *Surf. Interface Anal.* 2009, 41, 840–857, DOI: 10.1002/sia.3105 [Q3; IF1.220; Cited 19]
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