

Complete Curriculum Vitae / Steven M. George

| | |
|---------------------------------------|----|
| 1. 3-Page Curriculum Vitae | 2 |
| 2. Biographical Sketch | 5 |
| 3. Patents | 6 |
| 4. Publications | 8 |
| 5. Invited Talks | 30 |
| 6. Research Group | 52 |
| 7. Current & Pending Research Support | 54 |
| 8. Description of Service | 57 |

Curriculum Vitae - Steven M. George

Professor
Dept. of Chemistry and Biochemistry
Dept. of Chemical and Biological Engineering
University of Colorado
Boulder, CO. 80309

(303)-492-3398 Office
(303)-492-5894 FAX
Steven.George@Colorado.Edu Email

<http://www.colorado.edu/chem/DEC/people/georges.html> Faculty Profile Website
<http://www.colorado.edu/Chemistry/GeorgeResearchGroup/> Research Group Website

Education:

- University of California, Berkeley, Calif.; Ph. D. in Chemistry, March 1983; Thesis: "Picosecond Studies of Vibrational Linewidth Broadening in Liquids".
- Yale University, New Haven, Conn.; B.S. in Chemistry with highest honors, May 1977.
- Phillips Exeter Academy, Exeter N.H.; Graduated with high honors, June 1973.

Professional Experience:

- Professor, Dept. of Chemical and Biological Engineering, Univ. of Colorado, Boulder, Colorado, August 2001-Present.
- Professor, Dept. of Chemistry and Biochemistry, Univ. of Colorado, Boulder, Colorado, Sept. 1995- Present.
- Associate Professor, Dept. of Chemistry and Biochemistry, Univ. of Colorado, Boulder, Colorado, Jan. 1992- August 1995.
- Assistant Professor, Dept. of Chemistry, Stanford University, Stanford, Calif., Fall 1984 - Dec. 1991.
- Visiting Scientist: Exxon Corporate Research, Laboratories, Linden, N.J., Summer 1983 - Fall 1984.
- Bantrell Post-doctoral Research Fellow: Chemistry Dept., Calif. Inst. of Technology, Spring 1983 - Fall 1984.

Current and Recent Professional Activities:

- Member, *Thin Film Division Program Committee* for National American Vacuum Society Meeting, October 1999-Present.
- Member, *Thin Film Division Executive Committee*, American Vacuum Society, January 2007-December 2008.
- Trustee, *American Vacuum Society*, January 2007-December 2009.
- Chair, International Symposium of the American Vacuum Society, October 30-November 4, 2005, Boston, Massachusetts

- Member, Conference Committee for American Vacuum Society Topical Conference on *Atomic Layer Deposition* (ALD 2007), June 24-27, 2007, San Diego, California
- Member, Conference Committee for American Vacuum Society Topical Conference on *Atomic Layer Deposition* (ALD 2006), July 23-26, 2006, Seoul, Korea
- Member, Conference Committee for American Vacuum Society Topical Conference on *Atomic Layer Deposition* (ALD 2005), August 8-10, 2005, San Jose, California
- Member, Conference Committee for American Vacuum Society Topical Conference on *Atomic Layer Deposition* (ALD 2004), August 16-18, 2004, Helsinki, Finland
- Member, Conference Committee for American Vacuum Society Topical Conference on *Atomic Layer Deposition* (ALD 2003), August 3-6, 2003, San Jose, California
- Chair, *Thin Film Division* of the American Vacuum Society, January - December 2002.
- Member, Conference Committee for American Vacuum Society Topical Conference on *Atomic Layer Deposition* (ALD 2002), August 19-21, 2002, Seoul, Korea
- Chair, American Vacuum Society Topical Conference on *Atomic Layer Deposition* (ALD 2001), May 14-15, 2001, Monterey, California.
- Co-Founder, ALD NanoSolutions, Fall 2001.
- Vice Chair, *Thin Film Division* of the American Vacuum Society, January - December 2001.
- Member, *Thin Film Division Program Committee* for National American Vacuum Society Meeting, October 1999-Present.
- Member, *Board of Editors*, Surface Review and Letters, January 1998-Present.
- Member, Board of Assessment of NIST Programs, *Panel for Chemical Science and Technology*, National Research Council, January 1993-December 1998.
- Co-Chair, Gordon Research Conference on *Electronic Materials: Chemistry, Excitations and Processing*, July 6-10, 1997 in New Hampshire.
- Member, *Executive Committee of Electronic Materials and Processing Division*, American Vacuum Society, January 1996-December 1997.
- Co-Chair, Symposium on *Environmental Heterogeneous Processes*, American Chemical Society National Meeting, New Orleans, LA, March 24-28, 1996.
- Guest Editor, *Thematic Issue on Heterogeneous Catalysis*, Chemical Reviews, May 1995.
- Chair, *Microphysics of Surfaces: Nanoscale Processing*, Topical Meeting of the Optical Society of America, Sante Fe, NM, Feb. 9-11, 1995.
- Associate Editor, Chemical Reviews, July 1992- Dec. 1994.
- Member, National Materials Advisory Board Committee on *New Currency Design: Counterfeit Deterrent Features for the Next Generation*, June 1992-May 1994.
- Member, Defense Science Study Group, Institute for Defense Analysis, Alexandria, Virginia, Spring 1989- Fall 1991. Alumni Member, Fall 1991- Present.

Affiliations:

American Chemical Society; American Physical Society; American Vacuum Society; Materials Research Society.

Fellowships and Awards:

Faculty Research Award from College of Engineering and Applied Science, University of Colorado at Boulder, 2006

University of Colorado at Boulder Faculty Assembly Excellence in Research, Scholarly, and Creative Work Award, 2006
American Chemical Society Colorado Section Award, 2004
R&D 100 Award for *Particle-ALD*TM, 2004
Inventor of the Year, University of Colorado at Boulder, 2004
National Science Foundation Creativity Award, 2002-2004
Fellow, American Vacuum Society, 2000
Fellow, American Physical Society, 1997
Presidential Young Investigator Award, 1988-1993
Alfred P. Sloan Foundation Fellow, 1988
IBM Faculty Development Award, 1988
Dupont Young Faculty Awardee, 1988
Dreyfus Award for Newly Appointed Faculty in Chemistry, 1985
AT&T New Faculty Award, 1985
Bantrell Post-doctoral Research Fellow, Spring 1983-Fall 1984

Biographical Sketch

Prof. Steven M. George is Professor in the Dept. of Chemistry and Biochemistry and Dept. of Chemical and Biological Engineering at the University of Colorado at Boulder. Dr. George received his B.S. in Chemistry from Yale University (1977) and his Ph.D. in Chemistry from the University of California at Berkeley (1983). He has more than 200 peer-reviewed publications in the areas of surface science, thin film growth and physical chemistry. Dr. George is a *Fellow* of the American Vacuum Society (2000) and a *Fellow* of the American Physical Society (1997). He has also received a number of awards including the American Chemical Society Colorado Section Award (2004), Inventor of the Year, University of Colorado at Boulder (2004), R&D 100 Award for *Particle-ALD™* (2004), an NSF Presidential Young Investigator (1988-1993) and an Alfred P. Sloan Foundation Fellow (1988).

Prof. George's research interests are in the areas of surface chemistry, thin film growth and nanostructure engineering. He is currently directing an internationally recognized research effort focusing on atomic layer deposition (ALD). This ALD research is examining new ALD surface chemistry, measuring ALD thin film growth rates, characterizing the properties of ALD films and developing new flow reactors for rapid film growth using ALD techniques. Dr. George served as Chair of the first American Vacuum Society *Topical Conference on Atomic Layer Deposition* (ALD2001) held in Monterey, California. He was also on the Conference Committees for ALD2002 in Seoul, Korea, ALD2003 in San Jose, California, ALD2004 in Helsinki, Finland, ALD2005 in San Jose, California and ALD2006 in Seoul, Korea in July 2006. He is currently on the Conference Committee for ALD2007 in San Diego, California in June 2007.

Dr. George is very active in the American Vacuum Society. He is currently a Trustee of the American Vacuum Society and serves on the Executive Committee and Program Committee for the Thin Film Division. He also served as Program Chair for the National American Vacuum Society Meeting in November 2005 in Boston, Massachusetts. He has also served as Vice-Chair (2001) and Chair (2002) of the Thin Film Division of the American Vacuum Society. Dr. George also teaches a one-day short course on *Atomic Layer Deposition* for the American Vacuum Society. Other past organization roles include co-chairing the 1997 Gordon Conference on *Chemistry of Electronic Materials*. He is on the Editorial Board of *Surface Review & Letters*. Dr. George has also served as Guest Editor and Associate Editor for *Chemical Reviews* and has been a member of a number of national advisory boards. Dr. George is co-founder of ALD NanoSolutions, Inc., a startup company that is working to commercialize ALD technology. He also was a member of the Defense Science Study Group (1989-1991).

PATENTS / Steven M. George

1. J.L. Falconer, S.M. George, A.W. Ott, J.W. Klaus, R. Noble and H.H. Funke, "Modification of Zeolite or Molecular Sieve Membranes Using Atomic Layer Controlled Chemical Vapor Deposition", U.S. Patent Number 6,043,177, March 28, 2000.
2. J.L. Falconer, S.M. George, A.W. Ott, J.W. Klaus, R. Noble and H.H. Funke, "Modified Zeolite Membrane", U.S. Patent Number 6,051,517, April 18, 2000.
3. J.W. Klaus, O.Sneh and S.M. George, "Method of Growing Films on Substrates at Room Temperature Using Catalyzed Binary Reaction Sequence Chemistry", U.S. Patent 6,090,442, July 18, 2000.
4. S.M. George, J.D. Ferguson and A.W. Weimer, "Atomic Layer Controlled Deposition on Particle Surfaces", U.S. Patent Number 6,613,383, September 2, 2003.
5. A.W. Weimer, J.R. Wank and S.M. George, "Insulating and Functionalizing Fine Metal-Containing Particles with Conformal Ultra-thin Films", U.S. Patent Number 6,713,177, March 30, 2004.
6. J.W. Klaus and S.M. George, "Method for Forming SiO₂ by Chemical Vapor Deposition at Room Temperature", U.S. Patent Number 6,818,250, November 16, 2004.
7. S.M. George, J.D. Ferguson, A.W. Weimer and J.R. Wank, "Nanocoated Primary Particles and Method for Their Manufacture", U.S. Patent Number 6,913,827, July 5, 2005.
8. J.W. Klaus and S.M. George, "A Solid Material Comprising a Thin Metal Film on its Surface and Methods for Producing the Same", U.S. Patent 6,958,174, October 2005.
9. S.M. George, J.D. Ferguson, A.W. Weimer and C.A. Wilson, "Method for the Deposition of an Inorganic Film on an Organic Polymer, U.S. Patent Application Number 20040194691, PCT International Publication Number WO 03/008110 A1.
10. A.W. Weimer, S.E. Pratsinis, C. Angeletakis and S.M. George, "Dental Composite Filler Particles", U.S. Patent Application Number 20040224087.
11. A.W. Weimer, S.M. George and C. Dutcher, "Nanomaterials for Quantum Tunneling Varistors", U.S. Patent 7,132,687, November 7, 2006.
12. C.R. Metzner, S. Kher, Y.K. Kim, M.N. Rocklein and S.M. George, "Method for Hafnium Nitride Deposition", U.S. Patent Application Number 20040198069.
13. S.M. George and C.R. Herrmann, "Al₂O₃ Atomic Layer Deposition to Enhance the Deposition of Hydrophobic or Hydrophilic Coatings on Microelectromechanical Devices", U.S. Patent Application Number 20050012975.

14. S.J. Henderson and S.M. George, "High Reflectivity and Ultra-High Flux X-ray Optical Element Based on a Graded Multilayer Inside a Monocapillary Tube Fabricated Using Atomic Layer Deposition Techniques", U.S. Patent Application, filed PCT.
15. J.W. Elam, S.M. George, N. Hoivik and Y.C. Lee, "Atomic Layer Deposition of Conformal Protective Coating Layers for Released Microelectromechanical Devices", U.S. Patent Application.
16. A.W. Weimer, S.M. George, K.J. Buechler, J.A. McCormick and J.A. Spencer, "Methods for Producing Coated Phosphor and Host Material Particles Using Atomic Layer Deposition Methods", Application for Provisional Patent, June 2005.
17. T.K. Haraldsson, H. Sikes, C.N. Bowman, S.M. George and M.D. Groner, "Use of Photopolymerization for Amplification and Detection of a Molecular Recognition Event with Surface-Passivated Microfluidic Devices", Invention Disclosure CU1395B, Application for Provisional Patent, July 2005.
18. S.M. George, A.A. Dameron and N.M. Adamczyk, "Molecular Layer Deposition Process for Making Organic or Organic-Inorganic Polymers", University of Colorado Docket Number UTC 014. (Provisional Filed Fall 2006).
19. A.A. Dameron and S.M. George, "Hybrid Inorganic/Organic Polymers Made Using Molecular Layer Deposition Techniques", University of Colorado Docket Number UTC 015, app. No. 60/936,824. (Provisional Filed Spring 2007).
20. A.A. Dameron and S.M. George, "Protective Coatings for Organic Electronic Devices Made Using Atomic Layer Deposition and Molecular Layer Deposition Techniques", University of Colorado Docket Number UTC 016, app. No. 60/939,818. (Provisional Filed Spring 2007).

PUBLICATIONS / Steven M. George

1. C.R. Dickson, S.M. George and R.N. Zare, "Determination of Absolute Photon Yields Under Single-Collision Conditions," *J. Chem. Phys.* **67**, 1024-1030 (1977).
2. S.D. Colson, S.M. George, T. Keyes and V. Vaida, "Singlet and Triplet Exciton Percolation in Benzene Isotopic Mixed Crystals," *J. Chem. Phys.* **67**, 4941-4947 (1977).
3. J.H. Richardson and S.M. George, "Comparison of Different Experimental Configurations in Pulsed Laser Induced Molecular Fluorescence," *Anal. Chem.* **50**, 616-620 (1978).
4. J.H. Richardson, S.M. George, J.E. Harrar and S.P. Perone, "Laser Induced Photoelectrochemistry. Dependence of Photoemission-Related Currents on Laser Characteristics," *J. Phys. Chem.* **82**, 1818-1827 (1978).
5. S.P. Perone, J.H. Richardson, B.S. Shepard, J. Rosenthal, J.E. Harrar and S.M. George, "Laser Applications in Photoelectrochemistry," in *New Applications of Lasers to Chemistry*, ed. by G.M. Hieftje. ACS Symposium Series Vol. 85 (American Chemical Society, Washington, D.C., 1978) p. 126-170.
6. J.H. Richardson, S.M. George and M.E. Ando, "Sub-Part-Per-Trillion Detection of Organics in Aqueous Solution by Laser Induced Molecular Fluorescence," in *Trace Organic Analysis: A New Frontier in Analytical Chemistry*, National Bureau of Standards Special Publication 519 (National Bureau of Standards, Washington, D.C., 1979) p. 691-696.
7. C.B. Harris, H. Auweter and S.M. George, "Critical Test of Vibrational Dephasing Theories in Liquids by Use of Selective, Coherent, Picosecond Stokes Scattering," *Phys. Rev. Lett.* **44**, 737-740 (1980).
8. C.B. Harris, H. Auweter and S.M. George, "The Dynamics and Structure of Liquids Revealed by the Homogeneous and Inhomogeneous Broadening of Liquid Vibrational Transitions," in *Picosecond Phenomena II*, Vol. 14, Springer Series Chem. Phys., ed. by R. Hochstrasser, W. Kaiser and C.V. Shank (Springer-Verlag, Berlin, 1980) p. 151-155.
9. S.M. George, H. Auweter and C.B. Harris, "Inhomogeneous Broadening of Vibrational Linewidths in Polyatomic Liquids," *J. Chem. Phys.* **73**, 5573-5583 (1980).
10. S.M. George and C.B. Harris, "Passively Mode-Locked Nd:Glass Laser Oscillator Optimized for TEM-00 Selectivity and Long Term Stability and Reliability," *Rev. Sci. Instrum.* **52**, 852-857 (1981).
11. S.M. George, M. Berg, A.L. Harris and C.B. Harris, "Picosecond Pulse Shortening Using Dye #5 as a Saturable Absorber," Lawrence Berkeley Laboratory Report #12695, May 1981.
12. S.M. George and C.B. Harris, "Dependence of Inhomogeneous Vibrational Linewidth Broadening on Attractive Forces from Local Liquid Number Densities," *J. Chem. Phys.* **77**, 4781-4783 (1982).

13. S.M. George, A.L. Harris, M. Berg and C.B. Harris, "The Temperature Dependence of Homogeneous and Inhomogeneous Vibrational Linewidth Broadening Studied Using Coherent Picosecond Stokes Scattering," in *Picosecond Phenomena III*, Vol. 23, Springer Series Chem. Phys. by K.B. Eisenthal, R.M. Hochstrasser, W. Kaiser and A. Laubereau (Springer-Verlag, Berlin, 1982) p. 196-200.
14. S.M. George and C.B. Harris, "Theory for Selective-Vibrational-Dephasing Experiments with the Use of Transient Stimulated Raman Scattering in High Laser Depletion," *Phys. Rev.* **A28**, 863-878 (1983).
15. D. Ben-Amotz, S.M. George and C.B. Harris, "Transient Stimulated Raman Scattering in High Laser Depletion and its Effects on Vibrational Dynamics Experiments," *Chem. Phys. Lett.* **97**, 533-537 (1983).
16. D. Ben-Amotz, M. Berg, S.M. George, A.L. Harris and C.B. Harris, "Picosecond Vibrational Dephasing Experiments in Liquids Under High Laser Depletion Conditions," in *Applications of Picosecond Spectroscopy to Chemistry*, Proceedings of the NATO Advanced Research Workshop, ed. by K. Eisenthal (D. Reidel Publishing Company, Dordrecht, Holland, 1984) p. 165-172.
17. S.M. George, A.L. Harris, M. Berg and C.B. Harris, "Picosecond Studies of the Temperature Dependence of the Homogeneous and Inhomogeneous Vibrational Linewidth Broadening in Liquid Acetonitrile," *J. Chem. Phys.* **80**, 83-94 (1984).
18. S.M. George, "Surface Diffusion Measured Using Laser Induced Desorption," in *Proceedings of International Conference on Lasers '84* (Soc. for Optical and Quantum Electronics, McLean, Virginia, 1985) p. 23-29.
19. S.M. George, A.M. DeSantolo and R.B. Hall, "Diffusion of Hydrogen on Ni(100) Studied Using Laser Induced Thermal Desorption," *Surf. Sci.* **159**, L425-L432 (1985).
20. J.L. Brand and S.M. George, "Effects of Laser Pulse Characteristics and Thermal Desorption Parameters on Laser Induced Thermal Desorption," *Surf. Sci.* **167**, 341-362 (1986).
21. C.H. Mak and S.M. George, "A Simplified Method to Determine the Coverage Dependence of Surface Diffusion Coefficients," *Surf. Sci.* **172**, 509-523 (1986).
22. C.H. Mak, J.L. Brand, A.A. Deckert and S.M. George, "Surface Diffusion of Hydrogen on Ru(001) Studied Using Laser Induced Thermal Desorption," *J. Chem. Phys.* **85**, 1676-1680 (1986).
23. S.M. George, "A Simple and Versatile Liquid Nitrogen Cooled Cryostat on a Differentially Pumped Rotary Feedthrough," *J. Vac. Sci. Technol.* **A4**, 2394-2395 (1986).
24. A.A. Deckert and S.M. George, "Heating Rates Required for Laser Induced Thermal Desorption Studies of Surface Reaction Kinetics," *Surf. Sci.* **182**, L215-L220 (1987).

25. A.A. Deckert, J.L. Brand, C.H. Mak, B.G. Koehler, and S.M. George, "The Decomposition Kinetics of Methanol on Ru(001) Studied Using Laser Induced Thermal Desorption," *J. Vac. Sci. Technol.* **A5**, 518-519 (1987).
26. A.A. Deckert, J.L. Brand, C.H. Mak B.G. Koehler, and S.M. George, "The Decomposition of Methanol on Ru(001) Studied Using Laser Induced Thermal Desorption," *J. Chem. Phys.* **87**, 1936-1947 (1987).
27. C.H. Mak and S.M. George, "Surface Diffusion of Hydrogen on Ru(001): Transition State Theory Calculations," *Chem. Phys. Lett.* **135**, 381-386 (1987).
28. C.H. Mak, J.L. Brand, B.G. Koehler and S.M. George, "Surface Diffusion of Hydrogen on Carbon-Covered Ru(001) Surfaces Studied Using Laser-Induced Thermal Desorption," *J. Chem. Phys.* **87**, 2340-2345 (1987).
29. C.H. Mak, J.L. Brand, B.G. Koehler and S.M. George, "Coverage-Dependence of the Surface Diffusion of Hydrogen on Ru(001)," *Surf. Sci.* **191**, 108-120 (1987).
30. C.H. Mak, J.L. Brand, B.G. Koehler and S.M. George, "Isotope Effect on the Surface Diffusion of Hydrogen on Ru(001)," *Surf. Sci.* **188**, 312-320 (1987).
31. J.L. Brand, A.A. Deckert and S.M. George, "Surface Diffusion of Hydrogen on Sulfur-Covered Ru(001) Surfaces Studied Using Laser-Induced Thermal Desorption," *Surf. Sci.* **194**, 457-474 (1988).
32. C.H. Mak, A.A. Deckert and S.M. George, "Effect of Coadsorbed CO on the Surface Diffusion of Hydrogen on Ru(001)," *J. Chem. Phys.* **89**, 5242-5250 (1988).
33. N.J. Tro, A.M. Nishimura and S.M. George, "Interactions and Energy Transfer Between Molecules on Dielectric Surfaces: Phenanthrene on Al₂O₃ (1120)," *J. Vac. Sci. Technol.* **A6**, 852-853 (1988).
34. N.J. Tro, and S.M. George, "Temperature Programmed Spectroscopy for Surface Kinetic Analysis: Absorption and Laser-Induced Fluorescence Techniques," *Surf. Sci.* **197**, L246-L252 (1988).
35. P. Gupta, V.L. Colvin and S.M. George, "Hydrogen Desorption Kinetics from Monohydride and Dihydride Species on Silicon Surfaces," *Phys. Rev.* **B37**, 8234-8243 (1988).
36. P. Gupta, V.L. Colvin, J.L. Brand and S.M. George, "Hydrogen Desorption Kinetics from Silicon Surfaces Using Transmission FTIR," in *Deposition and Growth: Limits for Microelectronics*, ed. by G.W. Rubloff, AIP Conf. Proc. No. 167 (American Vac. Society, New York, 1988) p. 50.
37. B.G. Koehler, C.H. Mak, D.A. Arthur, P.A. Coon and S.M. George, "Desorption Kinetics of Hydrogen and Deuterium from Si(111)7x7 Studied Using Laser Induced Thermal Desorption," *J. Chem. Phys.* **89**, 1709-1718 (1988).

38. C.H. Mak, H.C. Andersen and S.M. George, "Monte Carlo Studies of Diffusion on Inhomogeneous Surfaces," *J. Chem. Phys.* **88**, 4052-4061 (1988).
39. S.M. George, "Surface Diffusion Measured Using Laser Induced Thermal Desorption: Hydrogen on Ru(001)," in *Diffusion at Interfaces: Microscopic Concepts*, ed. by M. Grunze, H.J. Kreuzer and J.J. Weimer Vol. 12, Springer Series in Surface Sciences (Springer-Verlag, Berlin, 1988) p. 2-18.
40. J.L. Brand, C.H. Mak, A.A. Deckert, B.G. Koehler and S.M. George, "Surface Diffusion on Carbon and Sulfur-Covered Ru(001) Studied Using Laser-Induced Thermal Desorption," *J. Vac. Sci. Technol.* **A6**, 842-843 (1988).
41. A.A. Deckert, J.L. Brand, M.V. Arena and S.M. George, "Surface Diffusion of CO on Ru(001) Studied Using Laser-Induced Thermal Desorption," *J. Vac. Sci. Technol.* **A6**, 794-795 (1988).
42. C.H. Mak, B.G. Koehler and S.M. George, "Surface Diffusion of Cycloalkanes on Ru(001)," *J. Vac. Sci. Technol.* **A6**, 856-857 (1988).
43. N.J. Tro, A.M. Nishimura, D.R. Haynes and S.M. George, "Surface Nucleation in the Crystallization Kinetics of Phenanthrene Multilayers on Al₂O₃(1120)," *Surf. Sci.* **207**, L961-L970 (1988).
44. A.A. Deckert, J.L. Brand, M.V. Arena and S.M. George, "Surface Diffusion of Carbon Monoxide on Ru(001) Studied Using Laser-Induced Thermal Desorption," *Surf. Sci.* **208**, 441-462 (1989).
45. N.J. Tro, A.M. Nishimura and S.M. George, "Disorder-Order Transition and Energy Transfer in Phenanthrene Adlayers on Al₂O₃(1120)," *J. Phys. Chem.* **93**, 3276-3282 (1989).
46. N.J. Tro, D.A. Arthur and S.M. George, "Infrared Free Electron Laser as a Probe of Surface Vibrational Dynamics," *J. Opt. Soc. Am.* **B6**, 995-1002 (1989).
47. N.J. Tro, D.A. Arthur and S.M. George, "Infrared Resonant Desorption of Butane from Al₂O₃(1120): Evidence for an Ordered Adlayer from Vibrational Mode Selectivity," *J. Chem. Phys.* **90**, 3389-3395 (1989).
48. C.H. Mak, B.G. Koehler and S.M. George, "Laser-Induced Thermal Desorption of Silicon-Containing Surface Reaction Intermediates from Si(111)7x7," *Surf. Sci. Lett.* **208**, L42-L52 (1989).
49. B.G. Koehler, C.H. Mak and S.M. George, "Decomposition of H₂O on Si(111)7x7 Studied Using Laser Induced Thermal Desorption," *Surf. Sci.* **221**, 565-589 (1989).
50. P. Gupta, C.H. Mak, P.A. Coon and S.M. George, "Oxidation Kinetics of Si(111)7x7 in the Submonolayer Regime," *Phys. Rev.* **B40**, 7739-7749 (1989).
51. B.G. Koehler, P.A. Coon and S.M. George, "Decomposition of NH₃ on Si(111)7x7 Studied

- Using Laser Induced Thermal Desorption,” *J. Vac. Sci. Technol.* **B7**, 1303-1310 (1989).
52. N.J. Tro, D.R. Haynes, A.M. Nishimura and S.M. George, “Coverage-Dependent Electronic Absorption Spectrum of Pyrene on Al₂O₃ (1120),” *Chem. Phys. Lett.* **159**, 599-604 (1989).
 53. N.J. Tro, D.R. Haynes, A.M. Nishimura and S.M. George, “Desorption Kinetics and Excimer Formation of Pyrene on Al₂O₃(1120),” *J. Chem. Phys.* **91** 5778-5785 (1989).
 54. N.J. Tro, D.R. Haynes, A.M. Nishimura and S.M. George, “Spectroscopy and Photophysics of Surface Adlayers,” in *Photochemistry in Thin Films*, ed. by T.F. George, SPIE Conference Proceedings Vol. 1056 (SPIE, Bellingham, Washington, 1989) p. 175-187.
 55. S.M. George, P. Gupta, C.H. Mak and P.A. Coon, “Oxidation Kinetics of Silicon Surfaces: Reactive Sticking Coefficient, Apparent Saturation Coverage and Effect of Surface Hydrogen,” in *Chemical Perspectives of Microelectronic Materials*, Mat. Res. Soc. Sym. Proc. **131**, 169-177 (1989).
 56. P. Gupta, P.A. Coon, B.G. Koehler and S.M. George, “Adsorption of Silicon Tetrachloride on Si(111)7x7,” in *Chemical Perspectives of Microelectronic Materials*, Mat. Res. Soc. Sym. Proc. **131**, 197-201 (1989).
 57. A.A. Deckert, J.L. Brand, M.V. Arena and S.M. George, “Effect of Sulfur on the Decomposition of Methanol on Ru(001),” *Surf. Sci.* **226**, 42-50 (1990).
 58. J.L. Brand, A.A. Deckert, M.V. Arena and S.M. George, “CO Desorption Kinetics from Clean and Sulfur-Covered Ru(001) Surfaces,” *J. Chem. Phys.* **92**, 4483-4490 (1990).
 59. J.L. Brand, A.A. Deckert, M.V. Arena and S.M. George, “Surface Diffusion of n-Alkanes on Ru(001),” *J. Chem. Phys.* **92**, 5136-5143 (1990).
 60. E.D. Westre, M.V. Arena, A.A. Deckert, J.L. Brand and S.M. George, “Surface Diffusion of Neopentane and Tetramethylsilane on Ru(001),” *Surf. Sci.* **233**, 293-307 (1990).
 61. M.V. Arena, A.A. Deckert, J.L. Brand, and S.M. George, “Surface Diffusion and Desorption of Pentane Isomers on Ru(001),” *J. Phys. Chem.* **94**, 6792-6797 (1990).
 62. S.M. George, P. Gupta, B.G. Koehler, C.H. Mak and P.A. Coon, “Laser Induced Thermal Desorption Studies of Reaction Kinetics on Si(111)7x7,” in *Proceedings of 1989 Internatl. Symp. on MicroProcess Conference*, ed. by S. Namba and T. Kitayama, Japanese J. of Appl. Physics Series 3, (1990) p. 267-269.
 63. S.M. George, P. Gupta, B.G. Koehler, P.A. Coon, A.C. Dillon and C.H. Mak, “Silicon Surface Kinetics Studied Using Laser Induced Thermal Desorption,” in *Laser Photoionization and Desorption Surface Analysis Techniques*, ed. by N.S. Nogar, SPIE Conference Proceedings Vol. 1208, (SPIE, Bellingham, Washington, 1990), p. 76-87.
 64. S.M. George, N.J. Tro and D.A. Arthur, “Vibrational Resonant Desorption from Surfaces Using the Infrared Free Electron Laser,” in *Free Electron Lasers and Applications*, ed. by D.

- Prosnitz, SPIE Conference Proceedings Vol. 1227, (SPIE, Bellingham, Washington, 1990) p. 145-157.
65. S.M. George, P. Gupta, B.G. Koehler, P.A. Coon, A.C. Dillon and C.H. Mak, "Optical Probes of Silicon Surface Chemistry," in Semiconductor Silicon 1990, ed. by H.R. Huff, K.G. Barraclough and J. Chikawa, Proceedings of Sixth International Symposium on Silicon Materials Science and Technology, Proceedings Volume 90-7 (Electrochem. Soc., Pennington, New Jersey 1990).
 66. P. Gupta, P.A. Coon, B.G. Koehler and S.M. George, "Adsorption and Desorption Kinetics for SiCl₄ on Si(111) 7x7," *J. Chem. Phys.* **93**, 2827-2835 (1990).
 67. D.R. Haynes, K.R. Helwig, N.J. Tro and S.M. George "Fluorescence Quenching of the Phenanthrene Excimer on Al₂O₃(0001): Coverage and Distance Dependence," *J. Chem. Phys.* **93**, 2836-2847 (1990).
 68. A.C. Dillon, P. Gupta, M.B. Robinson, A.S. Bracker and S.M. George, "FTIR Studies of Water and Ammonia Decomposition on Silicon Surfaces", *J. Electron Spectroscopy and Related Phenomena* **54/55**, 1085-1095 (1990).
 69. D.R. Haynes, K.R. Helwig, N.J. Tro and S.M. George, "Coverage-Dependent Electronic Absorption Spectrum of Phenanthrene on Al₂O₃(0001) and Butane Multilayer Surfaces," *J. Phys. Chem.* **95**, 839-844 (1991).
 70. B.G. Koehler and S.M. George, "Laser Induced Desorption of H₂ from Si(111)7x7," *Surf. Sci.* **248**, 158-172 (1991).
 71. P. Gupta, A.C. Dillon, A.S. Bracker, and S.M. George, "FTIR Studies of H₂O and D₂O Decomposition on Porous Silicon Surfaces," *Surf. Sci.* **245**, 360-372 (1991).
 72. A.C. Dillon, P. Gupta, M.B. Robinson, A.S. Bracker and S.M. George, "Ammonia Decomposition on Silicon Surfaces Studied Using Transmission FTIR Spectroscopy," *J. Vac. Sci. Technol.* **A9**, 2222-2230 (1991).
 73. P. Gupta, A.C. Dillon, P.A. Coon and S.M. George, "FTIR Studies Reveal that Silicon-Containing Laser-Induced Desorption Products are Surface Reaction Intermediates," *Chem. Phys. Lett.* **176**, 128-134 (1991).
 74. M.V. Arena, A.A. Deckert and S.M. George, "Coverage-Dependent Surface Diffusion Expected from a Multiple-Site Hopping Model," *Surf. Sci.* **241**, 369-377 (1991).
 75. M.V. Arena, E.D. Westre and S.M. George, "Surface Diffusion and Desorption of Perfluoro-n-butane on Ru(001)," *J. Chem. Phys.* **94**, 4001-4008 (1991).
 76. P. Gupta, P.A. Coon, B.G. Koehler and S.M. George, "Desorption Product Yields Following Cl₂ Adsorption on Si(111)7x7: Coverage and Temperature Dependence," *Surf. Sci.* **249**, 92-104 (1991).

77. M.L. Wise, B.G. Koehler, P. Gupta, P.A. Coon and S.M. George, "Comparison of H₂ Desorption Kinetics from Si(111)7x7 and Si(100) 2x1," in *Chemical Perspectives of Microelectronic Materials II*, Mat. Res. Soc. Sym. Proc. **204**, 319-325 (1991).
78. A.C. Dillon, P. Gupta, A.S. Bracker, M.B. Robinson and S.M. George, "FTIR Studies of Water and Ammonia Decomposition on Silicon Surfaces", in *Chemical Perspectives of Microelectronic Materials II*, Mat. Res. Soc. Sym. Proc. **204**, 339-344 (1991).
79. P.A. Coon, M.L. Wise, A.C. Dillon, M.B. Robinson and S.M. George, "Adsorption and Decomposition of Diethylsilane on Silicon Surfaces," in *Chemical Perspectives of Microelectronic Materials II*, Mat. Res. Soc. Sym. Proc. **204**, 303-309 (1991).
80. P. Gupta, P.A. Coon, B.G. Koehler, M.L. Wise and S.M. George, "Adsorption and Desorption Kinetics for Chlorosilanes on Si(111)7x7," in *Chemical Perspectives of Microelectronic Materials II*, Mat. Res. Soc. Sym. Proc. **204**, 311-317 (1991).
81. M.L. Wise, B.G. Koehler, P. Gupta, P.A. Coon and S.M. George, "Comparison of H₂ Desorption Kinetics from Si(111)7x7 and Si(100) 2x1," *Surf. Sci.* **258**, 166-176 (1991)
82. D.A. Arthur, D.L. Meixner, M. Boudart and S.M. George, "Adsorption, Desorption and Surface Diffusion Kinetics of NH₃ on MgO(100)." *J. Chem. Phys.* **95**, 8521-8531 (1991).
83. A.C. Dillon, M.B. Robinson, M.Y. Han and S.M. George, "Decomposition of Alkylsilanes on Silicon Surfaces Using Transmission FTIR Spectroscopy", in *Atomic Layer Growth and Processing*, Mat. Res. Soc. Sym. Proc. **222**, 213-218 (1991).
84. A. Tokmakoff, D.R. Haynes and S.M. George, "Desorption Kinetics of C₆₀ Multilayers from Al₂O₃(0001)," *Chem. Phys. Lett.* **186**, 450-455 (1991).
85. A.C. Dillon, M.B. Robinson, M.Y. Han and S.M. George, "Diethylsilane Decomposition on Silicon Surfaces Studied Using Transmission FTIR Spectroscopy." *J. Electrochem. Soc.* **139**, 537-543 (1992).
86. M.V. Arena, E.D. Westre and S.M. George, "Coverage-Dependence of n-Butane Surface Diffusion on a Stepped Ru(001) Surface." *Surf. Sci.* **261**, 129-140 (1992).
87. M.V. Arena, E.D. Westre and S.M. George, "Anisotropic Diffusion of n-Butane on a Stepped Ru(001) Surface," *J. Chem. Phys.* **96**, 808-816 (1992).
88. P.A. Coon, M.L. Wise, A.C. Dillon, M.B. Robinson and S.M. George, "Diethylsilane on Silicon Surfaces: Adsorption and Decomposition Kinetics." *J. Vac. Sci. Technol.* **B10**, 221-227 (1992).
89. P.A. Coon, P. Gupta, M.L. Wise and S.M. George, "Adsorption and Desorption Kinetics for SiH₂Cl₂ on Si(111)7x7," *J. Vac. Sci. Technol.* **A10**, 324-333 (1992).
90. D.L. Meixner, D.A. Arthur and S.M. George, "Kinetics of Desorption, Adsorption, and

- Surface Diffusion of CO₂ on MgO(100)," *Surf. Sci.* **261**, 141-154 (1992).
91. M.B. Robinson, A.C. Dillon, D.R. Haynes and S.M. George, "Effect of Surface Coverage on Porous Silicon Photoluminescence: Transmission FTIR Studies," in *Light Emission from Porous Silicon*, Mat. Res. Soc. Sym. Proc. **256**, 17-21 (1992).
 92. P.A. Coon, M.L. Wise, Z.H. Walker, S.M. George and D.A. Roberts, "Adsorption and Decomposition of Diethylgermane on Si(111)7x7," *Appl. Phys. Lett.* **60**, 2002-2004 (1992).
 93. D.R. Haynes, N.J. Tro and S.M. George, "Condensation and Evaporation of H₂O on Ice Surfaces," *J. Phys. Chem.* **96**, 8502-8509 (1992).
 94. A.C. Dillon, M.B. Robinson, S.M. George and P. Gupta, "Effects of Hydrogen Coverage on Silicon Surface Reactivity," in *Chemical Surface Preparation, Passivation and Cleaning for Semiconductor Growth and Processing*, Mat. Res. Soc. Sym. Proc. **259**, 99-104 (1992).
 95. M.B. Robinson, A.C. Dillon, D.R. Haynes and S.M. George, "Effect of Thermal Annealing and Surface Coverage on Porous Silicon Photoluminescence," *Appl. Phys. Lett.* **61**, 1414-1416 (1992).
 96. P.A. Coon, M.L. Wise and S.M. George, "Reaction Kinetics of GeCl₄ on Si(111)7x7," *Surf. Sci.* **278**, 383-396 (1992).
 97. S.M. George, "Laser Induced Thermal Desorption," in *Investigation of Interfaces and Surfaces-Part A, Physical Methods of Chemistry Series, 2nd Ed., Vol. IXA*, ed. by B.W. Rossiter and R.C. Baetzold (Interscience Publishers, John Wiley and Sons, New York, 1993) p. 453-497.
 98. P.A. Coon, M.L. Wise and S.M. George, "Modeling Silicon Epitaxial Growth with SiH₂Cl₂," *J. Crystal Growth* **130**, 162-172 (1993).
 99. P.A. Coon, M.L. Wise and S.M. George, "Adsorption Kinetics of Ethylsilane, Diethylsilane and Diethylgermane on Si(111)7x7", *J. Chem Phys.* **98**, 7485-7495 (1993).
 100. P.A. Coon, M.L. Wise, Z.H. Walker and S.M. George, "Ethyl Group Decomposition Kinetics Following Adsorption of Diethylsilane, Diethylgermane and Ethylsilane on Si(111)7x7", *Surf. Sci.* **291**, 337-348 (1993).
 101. D.L. Meixner and S.M. George, "Surface Diffusion of Xenon on Pt(111)", *J. Chem. Phys.* **98**, 9115-9125 (1993).
 102. D.L. Meixner and S.M. George, "Coverage Dependent Surface Diffusion of Noble Gases and Methane on Pt(111)", *Surf. Sci.* **297**, 27-39 (1993).
 103. A.C. Dillon, M.B. Robinson, S.M. George and D.A. Roberts, "Adsorption and Decomposition of Diethylgermane on Porous Silicon Surfaces", *Surf. Sci.* **286**, L535-L541 (1993).

104. M.B. Robinson, A.C. Dillon and S.M. George, "Porous Silicon Photoluminescence Versus HF Etching: No Correlation with Surface Hydrogen Species," *Appl. Phys. Lett.* **62**, 1493-1495 (1993).
105. A.C. Dillon, M.B. Robinson and S.M. George, "Comparison of Trichlorosilane and Trichlorogermane Decomposition on Silicon Surfaces Using FTIR Spectroscopy," in *Chemical Perspectives of Microelectronic Materials III*, Mat. Res. Soc. Sym. Proc. **282**, 405-411 (1993).
106. P.A. Coon, M.L. Wise, A.C. Dillon and S.M. George, "Germanium Deposition on Silicon: Surface Chemistry of $(\text{CH}_3\text{CH}_2)_2\text{GeH}_2$ and GeCl_4 ," in *Chemical Perspectives of Microelectronic Materials III*, Mat. Res. Soc. Sym. Proc. **282**, 413-419 (1993).
107. M.L. Wise, L.A. Okada, P.A. Coon and S.M. George, " SiO_2 Growth on $\text{Si}(111)7\times 7$ Using SiCl_4 and H_2O ," in *Chemical Perspectives of Microelectronic Materials III*, Mat. Res. Soc. Sym. Proc. **282**, 499-504 (1993).
108. M.B. Robinson, A.C. Dillon and S.M. George, "Porous Silicon Photoluminescence versus HF Etching: No Correlation with Surface Hydrogen Species," in *Microcrystalline Semiconductors - Materials Science and Devices*, Mat. Res. Soc. Sym. Proc. **283**, 191-196 (1993).
109. D.R. Haynes, A. Tokmakoff and S.M. George, "Temperature Dependent Absolute Quantum Yield of C_{60} Multilayers," *Chem. Phys. Lett.* **214**, 50-56 (1993).
110. E.D. Westre, D.E. Brown, J. Kutzner and S.M. George, "Surface Diffusion of Potassium on $\text{Ru}(001)$," *Surf. Sci.* **294**, 185-196 (1993).
111. A.C. Dillon, M.B. Robinson and S.M. George, "Decomposition of Silicon Hydrides Following Disilane Adsorption on Porous Silicon Surfaces," *Surf. Sci.* **295**, L998-L1004 (1993).
112. E.D. Westre, D.E. Brown, J. Kutzner and S.M. George, "Anisotropy and Coverage Dependence of CO Surface Diffusion on $\text{Ru}(S)-[15(001)\times 2(100)]$," *Surf. Sci.* **302**, 280-294 (1994).
113. D.R. Haynes, A. Tokmakoff and S.M. George, "Distance Dependence of Electronic Energy Transfer between Donor and Acceptor Adlayers: p-Terphenyl and 9,10-Diphenylanthracene," *J. Chem. Phys.* **100**, 1968-1980 (1994).
114. O. Sneh and S.M. George, "Xenon Diffusion on a Stepped $\text{Pt}(11,11,9)$ Surface," *J. Chem. Phys.* **101**, 3287-3297 (1994).
115. B.S. Berland, D.R. Haynes, K.L. Foster, M.A. Tolbert, S.M. George and O.B. Toon, "Refractive Indices of Amorphous and Crystalline $\text{HNO}_3/\text{H}_2\text{O}$ Films Representative of Polar Stratospheric Clouds," *J. Phys. Chem.* **98**, 4358-4364 (1994).

116. M.L. Wise, O. Sneh, L.A. Okada, A.C. Dillon and S.M. George, "Diethylethoxysilane as a New Precursor for SiO₂ Growth on Silicon" in *Gas Phase and Surface Chemistry in Electronic Materials Processing*, Mat. Res. Soc. Sym. Proc. **334**, 37-43 (1994).
117. O. Sneh, M.L. Wise, L.A. Okada, A.W. Ott and S.M. George, "Atomic Layer Growth of SiO₂ on Si(100) Using the Sequential Deposition of SiCl₄ and H₂O" in *Gas Phase and Surface Chemistry in Electronic Materials Processing*, Mat. Res. Soc. Sym. Proc. **334**, 25-30 (1994).
118. A.C. Dillon, A.W. Ott, S.M. George, and J.D. Way, "Atomic Layer Controlled Deposition of Al₂O₃ Films Employing Trimethylaluminum (TMA) and H₂O Vapor" in *Metal-Organic Chemical Vapor Deposition of Electronic Ceramics*, Mat. Res. Soc. Sym. Proc. **335**, 335-340 (1994).
119. B.S. Berland, D.R. Haynes, K.L. Foster, M.A. Tolbert, S.M. George and O.B. Toon, "Characterization of Model Polar Stratospheric Cloud Films Using Laser Induced Thermal Desorption and Optical Interference Techniques," in *Laser Techniques for Surface Science*, ed. by H.L. Dai and S.J. Sibener, SPIE Conference Proceedings, **Vol. 2125** (SPIE, Bellingham, Washington, 1994) p. 31-41.
120. A.M. Middlebrook, B.S. Berland, S.M. George, M.A. Tolbert and O.B. Toon, "Real Refractive Indices of Infrared-Characterized Nitric-Acid/Ice Films: Implications for Optical Measurements of PSCs", *J. Geophys. Res.* **99**, 25,655-25,666 (1994).
121. L.A. Okada, M.L. Wise and S.M. George, "Isothermal Desorption Kinetics from Si(100)2x1: Dependence on Disilane and Atomic Hydrogen Precursors", *Appl. Surf. Sci.* **82/83**, 410-416 (1994).
122. S.M. George, O. Sneh, A.C. Dillon, M.L. Wise, A.W. Ott and J.D. Way, "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", *Appl. Surf. Sci.* **82/83**, 460-467 (1994).
123. Y. Miyoshi, S. George, L. Okada, S. Miyazaki and M. Hirose, "In Situ Observation of Surface Reactions During Plasma Enhanced CVD Using FT-IR-ATR", *Proc. of 16th Symposium on Dry Process* (Tokyo, 1994) p. 151-156.
124. A.C. Dillon, A.W. Ott, S.M. George, and J.D. Way, "Surface Chemistry of Al₂O₃ Deposition Using Al(CH₃)₃ and H₂O in a Binary Reaction Sequence", *Surf. Sci.* **322**, 230-242 (1995).
125. M.V. Arena, E.D. Westre, D.E. Brown, J. Kutzner and S.M. George, "Surface Diffusion of Hydrogen on a Stepped Ru(001) Surface", *Surf. Sci.* **325**, 151-162 (1995).
126. A.C. Dillon, M.L. Wise, M.B. Robinson and S.M. George, "Adsorption and Decomposition of Trichlorosilane and Trichlorogermane on Porous Silicon and Si(100)2x1 Surfaces", *J. Vac. Sci. Technol.* **A13**, 1-10 (1995).

127. M.B. Robinson, A.C. Dillon and S.M. George, "Adsorption and Decomposition of Dichlorosilane on Porous Silicon Surfaces," *J. Vac. Sci. Technol.* **A13**, 35-41 (1995).
128. O. Sneh and S.M. George, "Sample Manipulator Employing a Gas-Thermal Switch Designed for High Pressure Experiments in an UHV Apparatus", *J. Vac. Sci. Technol.* **A13**, 493-496 (1995).
129. M.L. Wise, L.A. Okada, O. Sneh and S.M. George, "H₂O Adsorption Kinetics on Si(111)7x7 and Si(111)7x7 Modified by Laser-Annealing", *J. Vac. Sci. Technol.* **A13**, 1853-1860 (1995).
130. O. Sneh and S.M. George, "Thermal Stability of Hydroxyl Groups on a Well-Defined Silica Surface", *J. Phys. Chem.* **99**, 4639-4647 (1995).
131. M.L. Wise, O. Sneh, L.A. Okada and S.M. George, "Adsorption and Decomposition of Diethyldiethoxysilane (DEDEOS) on Silicon Surfaces: New Possibilities for SiO₂ Deposition", *J. Vac. Sci. Technol.* **B13**, 865-875 (1995).
132. O. Sneh, M.L. Wise, A.W. Ott, L.A. Okada and S.M. George, "Atomic Layer Growth of SiO₂ Using SiCl₄ and H₂O in a Binary Reaction Sequence", *Surf. Sci.* **334**, 135-152 (1995).
133. S.M. George, "Introduction: Heterogeneous Catalysis", *Chem. Rev.* **95**, 475 (1995).
134. B.S. Berland, D.E. Brown, M.A. Tolbert and S.M. George, "Refractive Index and Density of Vapor-Deposited Ice", *Geophys. Res. Lett.* **22**, 3493-3496 (1995).
135. E.D. Westre, D.E. Brown, J. Kutzner and S.M. George, "Surface Diffusion of Carbon Monoxide and Potassium Coadsorbed on Ru(001): Confirmation of a 1:1 CO:K Trapping Interaction", *J. Chem. Phys.* **104**, 7313-7324 (1996).
136. D.E. Brown, D.S. Sholl, R.T. Skodje and S.M. George, "Surface Diffusion of H and CO on Cu/Ru(001): Evidence for Long-Range Trapping by Copper Islands", *Chem. Phys.* **205**, 23-36 (1996).
137. O. Sneh, M.A. Cameron and S.M. George, "Adsorption and Desorption Kinetics of H₂O on a Fully Hydroxylated SiO₂ Surface", *Surf. Sci.* **364**, 61-78 (1996).
138. D.E. Brown, S.M. George, C. Huang, E.K.L. Wong, K.B. Rider, R.S. Smith and B.D. Kay, "H₂O Condensation Coefficient and Refractive Index for Vapor-Deposited Ice Obtained from Molecular Beam and Optical Interference Measurements", *J. Phys. Chem.* **100**, 4988-4995 (1996).
139. D.E. Brown and S.M. George, "Surface and Bulk Diffusion of H₂¹⁸O on Single-Crystal H₂¹⁶O Multilayers", *J. Phys. Chem.* **100**, 15460-15469 (1996).
140. M.L. Wise, O. Sneh, L.A. Okada and S.M. George, "Reaction Kinetics of H₂O with Chlorinated Si(111)7x7 and Porous Silicon Surfaces", *Surf. Sci.* **364**, 367-379 (1996).

141. A.W. Ott, K.C. McCarley, J.W. Klaus, J.D. Way and S.M. George, "Atomic Layer Controlled Deposition of Al₂O₃ Films Using Binary Reaction Sequence Chemistry", *Appl. Surf. Sci.* **107**, 128-136 (1996).
142. S.M. George, A.W. Ott and J.W. Klaus, "Surface Chemistry for Atomic Layer Growth", Special Centennial Issue of *J. Phys. Chem.* **100**, 13121-13131 (1996).
143. B.S. Berland, K.L. Foster, M.A. Tolbert and S.M. George, "UV Absorption Spectra of H₂O/HNO₃ Films Representative of Polar Stratospheric Clouds", *Geophys. Res. Lett.* **23**, 2757-2760 (1996).
144. A.W. Ott, J.W. Klaus, J.M. Johnson and S.M. George, "Al₂O₃ Thin Film Growth on Si(100) Using Binary Reaction Sequence Chemistry", *Thin Solid Films* **292**, 135-144 (1997).
145. A.W. Ott, J.W. Klaus, J.M. Johnson, S.M. George, K.C. McCarley and J.D. Way, "Modification of Porous Alumina Membranes Using Al₂O₃ Atomic Layer Controlled Deposition", *Chemistry of Materials* **9**, 707-714 (1997).
146. A.W. Ott, J.M. Johnson, J.W. Klaus and S.M. George, "Surface Chemistry of In₂O₃ Deposition Using In(CH₃)₃ and H₂O in a Binary Reaction Sequence", *Appl. Surf. Sci.* **112**, 205-215 (1997).
147. J.W. Klaus, A.W. Ott, J.M. Johnson and S.M. George, "Atomic Layer Controlled Growth of SiO₂ Films Using Binary Reaction Sequence Chemistry", *Appl. Phys. Lett.* **70**, 1092-1094 (1997).
148. S.M. George and F.E. Livingston, "Dynamic Ice Surface in the Polar Stratosphere", *Surface Review and Letters* **4**, 771-780 (1997).
149. F.E. Livingston, G.C. Whipple and S.M. George, "Diffusion of HDO into Single-Crystal H₂¹⁶O Ice Multilayers: Comparison with H₂¹⁸O", *J. Phys. Chem.* **B101**, 6127-6131 (1997).
150. K.L. Foster, M.A. Tolbert and S.M. George, "Interaction of HCl with Ice: Investigation of the Predicted Trihydrate, Hexahydrate, and Monolayer Regimes", *J. Phys. Chem.* **B101**, 4979-4986 (1997).
151. J.W. Klaus, O. Sneh and S.M. George, "Atomic Layer Controlled SiO₂ Growth at Room Temperature using Catalyzed Binary Reaction Sequence Chemistry", *Science* **278**, 1934-1936 (1997).
152. B.S. Berland, M.A. Tolbert and S.M. George, "Surface Sensitive Studies of the Reactive Uptake of Chlorine Nitrate on Ice", *J. Phys. Chem.* **A101**, 9954-9963 (1997).
153. A. Krasnopoler and S.M. George, "Infrared Resonant Desorption of H₂O from Ice Multilayers", *J. Phys. Chem.* **B102**, 788-794 (1998).

154. F. E. Livingston, G.C. Whipple and S.M. George, "Surface and Bulk Diffusion of HDO on Ultrathin Single-Crystal Ice Multilayers on Ru(001)", *J. Chem. Phys.* **108**, 2197-2207 (1998).
155. L.A. Okada, A.C. Dillon, A.W. Ott and S.M. George, "Adsorption and Decomposition of 1,4-Disilabutane ($\text{SiH}_3\text{CH}_2\text{CH}_2\text{SiH}_3$) on Si(100)2x1 and Porous Silicon Surfaces", *Surf. Sci.* **418**, 353-366 (1998).
156. J.W. Elam, C.E. Nelson, M.A. Cameron, M.A. Tolbert and S.M. George, "Adsorption of H_2O on Single-Crystal $\alpha\text{-Al}_2\text{O}_3(0001)$ Surfaces", *J. Phys. Chem.* **B102**, 7008-7015 (1998).
157. C.E. Nelson, J.W. Elam, M.A. Cameron, M.A. Tolbert and S.M. George, "Desorption of H_2O from a Hydroxylated Single-Crystal $\alpha\text{-Al}_2\text{O}_3(0001)$ Surface", *Surf. Sci.* **416**, 341-353 (1998).
158. F.E. Livingston and S.M. George, "HDO Diffusion Kinetics in Pure and Acid-Dosed Single-Crystal Ice Multilayers", *Diffusion and Defect Forum* **160-161**, 25-44 (1998).
159. J.W. Klaus, A.W. Ott, A.C. Dillon and S.M. George, "Atomic Layer Controlled Growth of Si_3N_4 Films Using Sequential Surface Reactions", *Surf. Sci.* **418**, L14-L19 (1998).
160. B.S. Berland, A.W. Ott, I.P. Gartland and S.M. George, "In Situ Monitoring of Atomic Layer Controlled Pore Reduction in Microporous Alumina Membranes Using Sequential Surface Reactions", *Chem. Mater.* **10**, 3941-3950 (1998).
161. F.E. Livingston and S.M. George, "Effect of HNO_3 and HCl on D_2O Desorption Kinetics from Crystalline D_2O Ice", *J. Phys. Chem.* **A102**, 10280-10288 (1998).
162. L.A. Okada and S.M. George, "Adsorption and Desorption Kinetics of Tetrakis(dimethylamino)titanium and Dimethylamine on TiN Surfaces", *Applied Surface Science* **137**, 113-124 (1999).
163. F.E. Livingston, J.A. Smith and S.M. George, "Origin of Non-Zero-Order H_2O Desorption Kinetics from Crystalline Ice Multilayers on Ru(001)", *Surf. Sci.* **423**, 145-159 (1999).
164. F.E. Livingston and S.M. George, "Effect of HNO_3 and HCl on HDO Diffusion on Single-Crystal D_2O Ice Multilayers", *J. Phys. Chem.* **B103**, 4366-4376 (1999).
165. M.A. Cameron and S.M. George, "ZrO₂ Film Growth by Chemical Vapor Deposition Using Zirconium Tetra-tert-Butoxide", *Thin Solid Films* **348**, 90-98 (1999).
166. J.W. Klaus, O. Sneh, A.W. Ott and S.M. George, "Atomic Layer Deposition of SiO_2 Using Catalyzed and Uncatalyzed Self-Limiting Surface Reactions", *Surface Review and Letters* **6**, 435-448 (1999).
167. S.M. George, S.J. Ferro and J.W. Klaus, "FTIR Studies of Tungsten and Tungsten Nitride Atomic Layer Deposition Using Sequential Surface Reactions", in *Proceedings of the*

Twelfth International Conference on Fourier Transform Spectroscopy (ICOFTS-12)
(Waseda University Enterprise Press, Tokyo, Japan, 1999) p. 143-146.

168. J.D. Ferguson, A.W. Weimer and S.M. George, "Atomic Layer Deposition of Al₂O₃ and SiO₂ on BN Particles Using Sequential Surface Reactions", *Appl. Surf. Sci.* **162-163**, 280-292 (2000).
169. J.W. Klaus, S.J. Ferro and S.M. George, "Atomic Layer Deposition of Tungsten Nitride Films Using Sequential Surface Reactions", *J. Electrochem. Soc.* **147**, 1175-1181 (2000).
170. J.W. Klaus and S.M. George, "Atomic Layer Deposition of SiO₂ at Room Temperature Using NH₃-Catalyzed Sequential Surface Reactions", *Surf. Sci.* **447**, 81-90 (2000).
171. J.W. Klaus and S.M. George, "SiO₂ Chemical Vapor Deposition at Room Temperature Using SiCl₄ + H₂O with a NH₃ Catalyst", *J. Electrochem. Soc.* **147**, 2658-2664 (2000).
172. J.W. Klaus, S.J. Ferro and S.M. George, "Atomic Layer Deposition of Tungsten Using Sequential Surface Chemistry with a Sacrificial Stripping Reaction", *Thin Solid Films* **360**, 145-153 (2000).
173. J.W. Klaus, S.J. Ferro and S.M. George, "Atomically Controlled Growth of Tungsten and Tungsten Nitride Using Sequential Surface Reactions", *Appl. Surf. Sci.* **162-163**, 479-491 (2000).
174. J.W. Elam, C.E. Nelson, M.A. Tolbert and S.M. George, "Adsorption and Desorption of HCl on a Single-Crystal α -Al₂O₃(0001) Surface", *Surf. Sci.* **450**, 64-77 (2000).
175. J.D. Ferguson, A.W. Weimer and S.M. George, "Atomic Layer Deposition of Ultrathin and Conformal Al₂O₃ Films on BN Particles", *Thin Solid Films* **371**, 95-104 (2000).
176. M.A. Cameron, I.P. Gartland, J.A. Smith, S.F. Diaz and S.M. George, "Atomic Layer Deposition of SiO₂ and TiO₂ in Alumina Tubular Membranes: Pore Reduction and Effect of Surface Species on Gas Transport", *Langmuir* **16**, 7435-7444 (2000).
177. J.D. Ferguson, A.W. Weimer and S.M. George, "Atomic Layer Deposition of SiO₂ Films on BN Particles Using Sequential Surface Reactions", *Chem. Mater.* **12**, 3472-3480 (2000).
178. S.M. George, J.D. Ferguson and J.W. Klaus, "Atom Layer Deposition of Thin Films Using Sequential Surface Reactions", in *New Methods, Mechanisms and Models of Vapor Deposition*, Mat. Res. Soc. Sym. Proc. **616**, 93-101 (2000).
179. F.E. Livingston, J.A. Smith and S.M. George, "Depth-Profiling and Diffusion Measurements in Ice Films Using Infrared Laser Resonant Desorption", *Anal. Chem.* **72**, 5590-5599 (2000).
180. C.E. Nelson, J.W. Elam, M.A. Tolbert and S.M. George, "H₂O and HCl Adsorption on Single-Crystal α -Al₂O₃(0001) at Stratospheric Temperatures", *Applied Surface Science*

- 171, 21-33 (2001).
181. P.K. Hudson, K.L. Foster, M.A. Tolbert, S.M. George, S.R. Carlo and V.H. Grassian, "HBr Uptake on Ice: Uptake Coefficient, H₂O/HBr Hydrate Formation and H₂O Desorption Kinetics", *J. Phys. Chem. A* **105**, 694-702 (2001).
 182. J.W. Elam, C.E. Nelson, R.K. Grubbs and S.M. George, "Nucleation and Growth During Tungsten Atomic Layer Deposition on SiO₂ Surfaces", *Thin Solid Films* **386**, 41-52 (2001).
 183. J.W. Elam, C.E. Nelson, R.K. Grubbs and S.M. George, "Kinetics of the WF₆ and Si₂H₆ Surface Reactions During Tungsten Atomic Layer Deposition", *Surf. Sci.* **479**, 121-135 (2001).
 184. F.E. Livingston and S.M. George, "Diffusion Kinetics of HCl Hydrates in Ice Measured Using Infrared Laser Resonant Desorption Depth-Profiling", *J. Phys. Chem. A* **105**, 5155-5164 (2001).
 185. J.R. Wank, S.M. George and A.W. Weimer, "Vibro-fluidization of Fine Boron Nitride Powder at Low Pressure", *Powder Technology* **121**, 195-204 (2001).
 186. S.M. George, J.W. Elam, R.K. Grubbs and C.E. Nelson, "Nucleation and Growth During Tungsten Atomic Layer Deposition on Oxide Surfaces", in *Mechanisms of Surface and Microstructure Evolution in Deposited Films and Film Structures*, Mat. Res. Soc. Sym. Proc. **672**, O7.7.1-O7.7.7 (2001).
 187. Wank, J.R., A.W. Weimer, J.D. Ferguson, and S.M. George, "Conformal Encapsulation of Fine Boron Nitride Particles with Oxide Nanolayers," in *Functionally Graded Materials 2000*, K. Trumble, K. Bowman, I. Reimanis, and S. Sampath, editors (The American Ceramic Society, Westerville, Ohio, 2001), *Ceram. Trans.* **114**, 441-449 (2001).
 188. Wank, J.R., S.M. George, and A.W. Weimer, "Conformal Ultrathin Non-conducting coatings on Conducting Fine Metal Particles," *Proceedings of the 2002 International Conference on Functionally Graded Materials* (Metal Powder Industries Federation, Princeton, New Jersey, 2002) pp. 26-33.
 189. F.E. Livingston, S.M. George and R.K. Shori, "Optimization of a Rotary Q-Switched Er:YAG Laser", *Rev. Sci. Instr.* **73**, 2526-2532 (2002).
 190. F.E. Livingston and S.M. George, "Effects of Sodium on HCl Hydrate Diffusion in Ice: Evidence for Anion-Cation Trapping", *J. Phys. Chem. A* **106**, 5114-5119 (2002).
 191. F.E. Livingston, J.A. Smith and S.M. George, "General Trends for Bulk Diffusion in Ice and Surface Diffusion on Ice", *J. Phys. Chem. A* **106**, 6309-6318 (2002).
 192. J.D. Ferguson, A.W. Weimer and S.M. George, "Atomic Layer Deposition of Boron Nitride Using Sequential Exposures of BCl₃ and NH₃", *Thin Solid Films* **413**, 16-25 (2002).

193. J.W. Elam, M.D. Groner and S.M. George, "Viscous Flow Reactor with Quartz Crystal Microbalance for Thin Film Growth by Atomic Layer Deposition", *Rev. Sci. Instrum.* **73**, 2981-2987 (2002).
194. J.W. Elam, Z.A. Sechrist and S.M. George, "ZnO/Al₂O₃ Nanolaminates Fabricated by Atomic Layer Deposition: Growth and Surface Roughness Measurements", *Thin Solid Films* **414**, 43-55 (2002).
195. M.D. Groner, J.W. Elam, F.H. Fabreguette and S.M. George, "Electrical Characterization of Thin Al₂O₃ Films Grown by Atomic Layer Deposition on Silicon and Various Metal Substrates", *Thin Solid Films* **413**, 186-197 (2002).
196. J.M. Jensen, A.B. Oelkers, R. Toivola, D.C. Johnson, J.W. Elam and S.M. George, "X-ray Reflectivity Characterization of ZnO/Al₂O₃ Multilayers Prepared Using Atomic Layer Deposition", *Chem. Mater.* **14**, 2276-2282 (2002).
197. M. Schuisky, J.W. Elam and S.M. George, "In Situ Resistivity Measurements During the Atomic Layer Deposition of ZnO and W Thin Films", *Appl. Phys. Lett.* **81**, 180-182 (2002).
198. N.D. Hoivik, J.W. Elam, S.M. George, K.C. Gupta, V.M. Bright and Y.C. Lee, "Atomic Layer Deposition (ALD) Technology for Reliable RF MEMS", in *Proceedings of the IEEE MTT-S 2002 International Microwave Symposium*, Seattle, WA, 2-7 June 2002, Symposium Digest, pp. 1229-1232.
199. J.W. Elam, Z.A. Sechrist and S.M. George, "Atomic Layer Deposition of ZnO/Al₂O₃ Nanolaminates and Alloys: Fabrication and Properties", *Proceedings of CIMTEC 2002*, International Conferences on Modern Materials and Technologies, Florence, Italy, July 14-18, 2002.
200. Y. Zhang, M.L. Dunn, J.W. Elam and S.M. George, "Suppression of Stress Relaxation in MEMS Multilayer Film Microstructures by Use of ALD Nanocoatings", *Proceedings of IMECE'02*, 2002 ASME International Mechanical Engineering Congress & Exposition, New Orleans, Louisiana, November 17-2002.
201. N.D. Hoivik, J.W. Elam, R.J. Linderman, V.M. Bright, S.M. George and Y.C. Lee, "Atomic Layer Deposited Protective Coatings for Micro-Electromechanical Systems", *Sensor Actuat. A* **103**, 100-108 (2003).
202. J.W. Elam and S.M. George, "Growth of ZnO/Al₂O₃ Alloy Films Using Atomic Layer Deposition", *Chem. Mater.* **15**, 1020-1028 (2003).
203. J.W. Elam, D. Routkevitch and S.M. George, "Properties of ZnO/Al₂O₃ Alloy Films Grown Using Atomic Layer Deposition Techniques", *J. Electrochem. Soc.* **150**, G339-G347 (2003).
204. K. Gall, M. Hulse, M.L. Dunn, D. Finch, S.M. George and B.A. Corff, "Thermo-Mechanical Response of Bare and Al₂O₃ Nanocoated Au/Si Bilayer Beams for MEMS", *J. Mater. Res.* **18**, 1575-1587 (2003).

205. J.A. Smith, F.E. Livingston and S.M. George, "Isothermal Desorption Kinetics of Crystalline H₂O, H₂¹⁸O and D₂O Ice Multilayers", *J. Phys. Chem. B* **107**, 3871-3877 (2003).
206. J.W. Elam, M. Schuisky, J.D. Ferguson and S.M. George, "Surface Chemistry and Film Growth During TiN Atomic Layer Deposition using TDMAT and NH₃", *Thin Solid Films* **436**, 145-156 (2003).
207. J.W. Elam, C.A. Wilson, M.Schuisky, Z.A. Sechrist and S.M. George, "Improved Nucleation on TiN ALD Films on SiLK Low-k Polymer Dielectric Using an Al₂O₃ ALD Adhesion Layer", *J. Vac. Sci. Technol. B* **21**, 1099-1107 (2003).
208. T.M. Mayer, J.W. Elam, S.M. George and P.G. Kotula, "Atomic Layer Deposition of Wear-Resistant Coatings for Micromechanical Devices", *Appl. Phys. Lett.* **82**, 2883-2885 (2003).
209. M.D. Groner and S.M. George, "High-k Dielectrics Grown by Atomic Layer Deposition: Capacitor and Gate Applications" Chapter 10 in Interlayer Dielectrics for Semiconductor Technologies. S.P. Murarka, M. Eizenbert and A.K. Sinha, Eds., (Elsevier Academic Press, Amsterdam, 2003) pp. 327-348.
210. J.W. Elam, D. Routkevitch, P.P. Markilovich and S.M. George, "Conformal Coating on Ultrahigh-Aspect-Ratio Nanopores of Anodic Alumina by Atomic Layer Deposition", *Chem. Mater.* **15**, 3507-3517 (2003).
211. M.N. Rocklein and S.M. George, "Temperature-Induced Apparent Mass Changes Observed during Quartz Crystal Microbalance Measurements of Atomic Layer Deposition", *Anal. Chem.* **75**, 4975-4982 (2003).
212. K. Gall, M. L. Dunn, M. Hulse, D. Finch and S. M. George, "Effect of Al₂O₃ Nanocoatings on the Thermo-Mechanical Behavior of Au/Si MEMS Structures", Conference Proceedings of the IEEE International Reliability Physics Symposium, Dallas, Texas, March 30-April 4, 2003, pp. 463-472.
213. J.D. Ferguson, A.R. Yoder, A.W. Weimer and S.M. George, "TiO₂ Atomic Layer Deposition on ZrO₂ Particles Using Alternating Exposures of TiCl₄ and H₂O", *Appl. Surf. Sci.* **226**, 393-404 (2004).
214. R.K. Grubbs, J.W. Elam, C.E. Nelson and S.M. George, "Nucleation and Growth During Tungsten ALD on Al₂O₃ Surfaces and Al₂O₃ ALD on Tungsten Surfaces", *Thin Solid Films* **467**, 16-27 (2004).
215. M.D. Groner, F.H. Fabreguette, J.W. Elam and S.M. George, "Low Temperature Al₂O₃ Atomic Layer Deposition", *Chem. Mater.* **16**, 639-645 (2004).
216. J.D. Ferguson, E.R. Smith, A.W. Weimer and S.M. George, "Atomic Layer Deposition of SiO₂ at Room Temperature using TEOS and H₂O with NH₃ as the Catalyst", *J. Electrochem. Soc.* **151**, G528-G535 (2004).

217. R.K. Grubbs, N.J. Steinmetz and S.M. George, "Gas Phase Reaction Products during Tungsten Atomic Layer Deposition Using WF_6 and Si_2H_6 ", *J. Vac. Sci. Technol. B* **22**, 1811-1821 (2004).
218. R.M. Costescu, D.G. Cahill, F.H. Fabreguette, Z.A. Sechrist and S.M. George, " Ultra-Low Thermal Conductivity in W/Al_2O_3 Nanolaminates", *Science* **303**, 989-990 (2004).
219. J.D. Ferguson, A.W. Weimer and S.M. George, "Atomic Layer Deposition of Al_2O_3 Films on Polyethylene Particles", *Chem. Mater.* **16**, 5602-5609 (2004).
220. J.R. Wank, S.M. George and A.W. Weimer, "Coating Fine Nickel Particles with Al_2O_3 Utilizing an Atomic Layer Deposition-Fluidized Bed Reactor (ALD-FBR)", *J. Am. Ceramic Soc.* **87**, 762-765 (2004).
221. J.R. Wank, S.M. George and A.W. Weimer, "Nanocoating Individual Cohesive Boron Nitride Particles in a Fluidized Bed by ALD", *Powder Technology* **142**, 59-69 (2004).
222. Y. Zhang, M.L. Dunn, K. Gall, J.W. Elam and S.M. George, "Suppression of Inelastic Deformation of Nanocoated Thin Film Microstructures", *J. Appl. Phys.* **95**, 8216-8225 (2004).
223. S.W. Kang, S.W. Rhee and S.M. George, "Infrared Spectroscopic Study of Atomic Layer Deposition (ALD) Mechanism for Hafnium Silicate Thin Films Using $HfCl_2[N(SiMe_3)_2]$ and H_2O ", *J. Vac. Sci. Technol. A* **22**, 2392-2397 (2004).
224. J.D. Ferguson, A.W. Weimer and S.M. George, "Surface Chemistry and Infrared Absorbance Changes during ZnO Atomic Layer Deposition on ZrO_2 and $BaTiO_3$ Particles", *J. Vac. Sci. Technol. A* **23**, 118-125 (2005).
225. F.H. Fabreguette, Z.A. Sechrist, J.W. Elam and S.M. George, "Quartz Crystal Microbalance Study of Tungsten Atomic Layer Deposition using WF_6 and Si_2H_6 ", *Thin Solid Films* **488**, 103-110 (2005).
226. C.F. Herrmann, F.W. DelRio, V.M. Bright and S.M. George, "Conformal Hydrophobic Coatings Prepared Using Atomic Layer Deposition Seed Layers and Non-Chlorinated Hydrophobic Precursors", *J. Micromech. Microeng.* **15**, 984-992 (2005).
227. Y. Du, X. Du and S.M. George, " SiO_2 Film Growth at Low Temperatures by Catalyzed Atomic Layer Deposition in a Viscous Flow Reactor", *Thin Solid Films* **491**, 43-53 (2005).
228. C.F. Herrmann, F.W. DelRio, S.M. George and V.M. Bright, "Properties of Atomic Layer Deposited Al_2O_3/ZnO Dielectric Films Grown at Low Temperature for RF MEMS", *Proceedings of SPIE* **5715**, 159-166 (2005).
229. M.K. Tripp, F.H. Fabreguette, C.H. Herrmann, S.M. George and V.M. Bright, "Multilayer Coating Technique to Enhance X-Ray Reflectivity of Polysilicon Micro-Mirrors at 1.54 Å Wavelength", *Proceedings of SPIE* **5720**, 241-251 (2005).

230. X. Du, Y. Du and S.M. George, "In Situ Examination of Tin Oxide Atomic Layer Deposition Using QCM and FTIR Techniques", *J. Vac. Sci. Technol. A* **23**, 581-588 (2005).
231. D.C. Miller, C.F. Herrmann, H.J. Maier, S.M. George, C.R. Stoldt and K. Gall, "Intrinsic Stress Development and Microstructure Evolution of Au/Cr/Si Multilayer Thin Films Subject to Annealing", *Scripta Materialia* **52**, 873-879 (2005).
232. C.F. Herrmann, F.H. Fabreguette, D.S. Finch, R. Geiss and S.M. George, "Multilayer and Functional Coatings on Carbon Nanotubes Using Atomic Layer Deposition", *Appl. Phys. Lett.* **87**, Art. No. 123110 (2005).
233. L.F. Hakim, S.M. George and A.W. Weimer, "Conformal Nanocoating of Primary Zirconia Nanoparticles by Atomic Layer Deposition in a Fluidized Bed Reactor", *Nanotechnology* **16**, S375-S381 (2005).
234. M.J. Pellin, P.C. Stair, G. Xiong, J.W. Elam, J. Birrell, L. Curtiss, S.M. George, C.Y. Han, L. Iton, H. Kung, M. Kung and H.H. Wang, "Mesoporous Catalytic Membranes: Synthetic Control of Pore Size and Wall Composition", *Catalysis Letters* **102**, 127-130 (2005).
235. J.D. Ferguson, K.J. Buechler, A.W. Weimer and S.M. George, "SnO₂ Atomic Layer Deposition on ZrO₂ and Al Nanoparticles: Pathway to Enhanced Thermite Materials", *Powder Technology* **156**, 154-163 (2005).
236. Z.A. Sechrist, F.H. Fabreguette, O. Heintz, T.M. Phung, D.C. Johnson and S.M. George, "Optimization and Structural Characterization of W/Al₂O₃ Nanolaminates Grown Using Atomic Layer Deposition Techniques", *Chem. Mater.* **17**, 3475-3485 (2005).
237. C.A. Wilson, R.K. Grubbs and S.M. George, "Nucleation and Growth during Al₂O₃ Atomic Layer Deposition on Polymers", *Chem. Mater.* **17**, 5625-5634 (2005).
238. L.F. Hakim, J. Blackson, S.M. George and A.W. Weimer, "Nanocoating Individual Silica Nanoparticles by Atomic Layer Deposition in a Fluidized Bed Reactor", *Chem. Vap. Deposition* **11**, 420-425 (2005).
239. M.D. Groner, S.M. George, R.S. McLean and P.F. Carcia, "Gas Diffusion Barriers on Polymers Using Al₂O₃ Atomic Layer Deposition", *48th Technical Conference Proceedings of the Society of Vacuum Coaters (SVC)*, pages 169-172 (2005).
240. F.H. Fabreguette, R.W. Wind and S.M. George, "Ultra-high X-Ray Reflectivity from W/Al₂O₃ Multilayers Fabricated Using Atomic Layer Deposition", *Appl. Phys. Lett.* **88**, Art. No. 013116 (2006).
241. M.D. Groner, S.M. George, R.S. McLean and P.F. Carcia, "Gas Diffusion Barriers on Polymers Using Al₂O₃ Atomic Layer Deposition", *Appl. Phys. Lett.* **88**, Art. No. 051907 (2006).

242. R.K. Grubbs and S.M. George, "Attenuation of Hydrogen Radicals Traveling under Flowing Gas Conditions Through Tubes of Different Materials ", *Journal of Vacuum Science & Technology A* **24**, 486-496 (2006).
243. Z.A. Sechrist, B.T. Schwartz, J.H. Lee, J.A. McCormick, R. Piestun, W. Park, and S.M. George, "Modification of Opal Photonic Crystals Using Al₂O₃ Atomic Layer Deposition", *Chem. Mater.* **18**, 3562-3570 (2006).
244. P.F. Carcia, R.S. McLean, M.H. Reilly, M.D. Groner and S.M. George, "Ca-Tests of Al₂O₃ Gas Diffusion Barriers Grown by Atomic Layer Deposition on Polymers", *Appl. Phys. Lett.* **89**, 031915 (2006).
245. M.K. Tripp, C. Stampfer, D.C. Miller, T. Helbling, C.F. Herrmann, C. Hierold, K. Gall, S.M. George and V.M. Bright, "The Mechanical Properties of Atomic Layer Deposited Alumina for Use in Micro- and Nano-Electromechanical Systems", *Sensors and Actuators A* **130-131**, 419-429 (2006).
246. L.F. Hakim, J.A. McCormick, G.D. Zhan, A.W. Weimer, P. Li and S.M. George, "Surface Modification of Titania Nanoparticles Using Ultrathin Ceramic Films", *J. Am. Ceram. Soc.* **89**, 3070-3075 (2006).
247. C.F. Herrmann, F. W. DelRio, D.C. Miller, S.M. George, V.M. Bright, J.L. Ebel, R.E. Strawser, R Cortez and K.D. Leedy, "Alternative Dielectric Films for RF MEMS Capacitive Switches Deposited Using Atomic Layer Deposited Al₂O₃/ZnO Alloys", *Sensors and Actuators A* **135**, 262-272 (2007).
248. D.C. Miller, C.F. Herrmann, H.J. Maier, S.M. George, C.R. Stoldt and K. Gall, "Thermo-Mechanical Evolution of Multilayer Thin Films, Part I: Mechanical Behavior of Au/Cr/Si Microcantilevers", *Thin Solid Films* **515**, 3208-3223 (2007).
249. D.C. Miller, C.F. Herrmann, H.J. Maier, S.M. George, C.R. Stoldt and K. Gall, "Thermo-Mechanical Evolution of Multilayer Thin Films, Part II: Microstructure Evolution in Au/Cr/Si Microcantilevers", *Thin Solid Films* **515**, 3224-3240 (2007).
250. Y. Du, X. Du and S. M. George, "Mechanism of Pyridine-Catalyzed SiO₂ Atomic Layer Deposition Studied by Fourier Transform Infrared Spectroscopy", *Journal of Physical Chemistry C* **111**, 219-226 (2007).
251. J.A. McCormick, B.L. Cloutier, A.W. Weimer and S.M. George, "Rotary Reactor for Atomic Layer Deposition on Large Quantities of Nanoparticles", *Journal of Vacuum Science & Technology A* **25**, 67-74 (2007).
252. X.H. Liang, L.F. Hakim, G.D. Zhan, J.A. McCormick, S.M. George, A.W. Weimer, J.A. Spencer II, K.J. Buechler, J. Blackson, C.J. Wood and J.R. Dorgan, "Polymer/Ceramic Nanocomposites Produced by Extruding ALD Nanocoated Polymer Particles," *J. Am Ceram. Soc.* **90**, 57-63 (2007).

253. J.A. McCormick, K.P. Rice, D.F. Paul, A.W. Weimer and S.M. George, "Al₂O₃ Atomic Layer Deposition on ZrO₂ Nanoparticles in a Rotary Reactor" *Chemical Vapor Deposition* (In Press).
254. F.H. Fabreguette and S.M. George, "X-Ray Mirrors on Flexible Polymer Substrates Fabricated by Atomic Layer Deposition" *Thin Solid Films* **515**, 7177-7180 (2007).
255. L.F. Hakim, D.M. King, Y. Zhou, C.J. Gump, S.M. George and A.W. Weimer, "Nanoparticle Coating for Advanced Optical, Mechanical and Rheological Properties," *Advanced Functional Materials* (In Press).
256. D.S. Finch, T. Oreskovic, K. Ramadurai, C.F. Herrmann, S.M. George and R.L. Mahajan, "Biocompatibility of Atomic Layer-Deposited Alumina Thin Films", *Journal of Biomedical Materials Research, Part A* (In Press).
257. Y. Du and S.M. George, "Molecular Layer Deposition of Nylon 66 Films Examined Using In Situ FTIR Spectroscopy" *Journal of Physical Chemistry C* **111**, 8509-8517 (2007).
258. R. Cooper, H.P. Upadhyaya, T.K. Minton, M.R. Berman, X. Du and S.M. George, "Protection of Polymer from Atomic-Oxygen Erosion Using Al₂O₃ Atomic Layer Deposition Coatings", *Thin Solid Films* (In Press).
259. X.H. Liang, S.M. George, A.W. Weimer, N.H. Li, J. Blackson, J. Harris and P. Li, "Synthesis of a Novel Porous Polymer/Ceramic Composite Material by Low-Temperature Atomic Layer Deposition", *Chemistry of Materials* (In Press).
260. M.D. Groner, J.A. McCormick, F.H. Fabreguette and S.M. George, "Copper Atomic Layer Deposition Using In Situ Generated Copper Chloride and Hydrogen Radicals", Submitted to *Journal of Vacuum Science & Technology B*.
261. G.B. Rayner, Jr. and S.M. George, "Nucleation and Growth of Tantalum Nitride Atomic Layer Deposition on Al₂O₃ Using TBTDET and Hydrogen Radicals", Submitted to *Journal of Vacuum Science and Technology B*.
262. M.A. Weimer, M.D. Groner, X. Liang, P. Li, S.M. George and A.W. Weimer, "Ultrafast Varistors Based on Nickel Particles with Tunable Al₂O₃ Tunnel Barriers", Submitted to *Applied Physics Letters*.
263. C.A. Wilson, J.A. McCormick, A.S. Cavanagh, D.N. Goldstein, A.W. Weimer and S.M. George, "Tungsten Atomic Layer Deposition on Polymers", Submitted to *Thin Solid Films*.
264. L.L. Liu, O.M. Mukdadi, M.K. Tripp, C.F. Herrmann, J.R. Hertzberg, S. M. George, V.M. Bright and R. Shandas, "Atomic Layer Deposition for Fabricating Capacitive Micromachined Ultrasonic Transducers: Initial Characterization", Submitted to *Sensors and Materials*.

265. C.A. Wilson, D.N. Goldstein, J.A. McCormick, A.W. Weimer and S.M. George, "Tungsten Atomic Layer Deposition on Cobalt Nanoparticles", **Submitted** to *Journal of Vacuum Science and Technology A*.
266. N.M. Adamczyk, A.A. Dameron and S.M. George, "Molecular Layer Deposition of Poly(p-phenylene terephthalamide) Films Using Terephthaloyl Chloride and p-Phenylenediamine", **Submitted** to *Langmuir*.
267. A.A. Dameron, S.D. Davidson, B.B. Burton, P.F. Carcia, R.S. McLean and S.M. George, "Gas Diffusion Barriers on Polymers Using Multilayers Fabricated by Al₂O₃ and Rapid SiO₂ Atomic Layer Deposition", **Submitted** to *Journal of Physical Chemistry C*.
268. B.B. Burton, A.R. Lavoie and S.M. George, "Tantalum Nitride Atomic Layer Deposition Using Tris(diethylamido)(*tert*-butylimido)tantalum and Hydrazine", **Submitted** to *Journal of The Electrochemical Society*.

INVITED TALKS / Steven M. George

1. "Surface Diffusion Measured Using Laser-Induced Desorption," Internatl. Conf. on Lasers 1984, San Francisco, Calif., Nov. 26, 1984.
2. "Surface Diffusion on Ru(001) Measured Using Laser-Induced Thermal Desorption," Surface Science and Catalysis Seminar, Lawrence Berkeley Laboratory, University of Calif., Berkeley, Calif., Dec. 5, 1985.
3. "Surface Diffusion Using Laser-Induced Thermal Desorption," Symposium on 'Innovative Chemical Processes on Semiconductors and Surfaces,' Am. Phys. Soc. Natl. Meeting, New York, New York, March 16, 1987.
4. "Surface Diffusion of Hydrogen on Ru(001) Surfaces Measured Using Laser-Induced Thermal Desorption," Phoebe Apperson Hearst Distinguished Lecture Series in 'Surface Science in Engineering,' Univ. of California, Berkeley, Calif., April 10, 1987.
5. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Thin Films and Interfaces Seminar Series, Lockheed Palo Alto Research Laboratories, Palo Alto, Calif., April 28, 1987.
6. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Earth Sciences Dept., Stanford Univ., Stanford, Calif., May 7, 1987.
7. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Dept. of Chemistry, Univ. of California, Irvine, Calif., May 12, 1987.
8. "Diffusion and Desorption of Hydrogen on Surfaces," Xerox Palo Alto Research Center, Electronics Materials Laboratory, Palo Alto, Calif., June 19, 1987.
9. "Diffusion and Desorption of Hydrogen on Surfaces," Signetics Phillips Research Center, Sunnyvale, Calif., June 23, 1987.
10. "Measurement of Surface Diffusion Using Laser-Induced Thermal Desorption," Gordon Research Conf. on the Dynamics of Gas-Surface Interactions, Proctor Academy, Andover, New Hampshire, August 11, 1987.
11. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption: Hydrogen on Ru(001)," Int. Conf. on Diffusion at Interfaces: Microscopic Concepts, Campobello Island, Nova Scotia, August 19, 1987.
12. "Laser-Induced Desorption Studies of Surface Dynamics," ACS State-of-the-Art Symposium on 'Chemistry at the Interface,' Am. Chem. Soc. Natl. Meeting, New Orleans, LA, Sept. 2, 1987.
13. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Am. Chem. Soc.

- Natl. Meeting, New Orleans, LA, Sept. 3, 1987.
14. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Sandia Natl. Laboratory, Albuquerque, N.M., Oct. 2, 1987.
 15. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Dept. of Chemistry, Univ. of Calif., Los Angeles, Calif., Nov. 3, 1987.
 16. "Surface Diffusion Measured Using Laser Induced Thermal Desorption," Dept. of Chemistry, Univ. of Calif., Davis, Calif., March 15, 1988.
 17. "Temperature-Programmed Spectroscopy for Surface Kinetic Analysis," IBM Almaden Research Center, San Jose, Calif., March 25, 1988.
 18. "Oxidation Kinetics of Silicon Surfaces in the Submonolayer Regime," Intel Corporation, Santa Clara, Calif., April 26, 1988.
 19. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Photographic Research Laboratory, Eastman Kodak Company, Rochester, New York, May 3, 1988.
 20. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Dept. of Chemistry, Harvard University, Cambridge, Mass., May 4, 1988.
 21. "Surface Diffusion Measured Using Laser-Induced Thermal Desorption," Dept. of Chemistry, Univ. of Utah, Salt Lake City, Utah, May 17, 1988.
 22. "Energy Transfer and the Disorder-Order Transition in Phenanthrene Adlayers on $\text{Al}_2\text{O}_3(1120)$," Third Chemical Congress of North America, Symposium on Photoprocesses and Spectroscopy at Surfaces and Interfaces, Toronto, Ontario, Canada, June 10, 1988.
 23. "Spectroscopy and Diffusion of Molecules on Surfaces Using Laser Induced Desorption," Adriatico Research Conference on Applications of Lasers in Surface Science, International Center for Theoretical Physics, Trieste, Italy, August 25, 1988.
 24. "Reaction Kinetics on Si(111) 7x7 Studied Using Laser Induced Thermal Desorption," Xerox Palo Alto Research Center, Electronics Materials Laboratory, Palo Alto, Calif., Sept. 9, 1988.
 25. "Reaction Kinetics on Silicon Surfaces," Dept. of Chemistry, Massachusetts Inst. of Technology, Cambridge, Mass., Sept. 13, 1988.
 26. "Reaction Kinetics on Silicon Surfaces," Hewlett-Packard Research Center, Palo Alto, Calif., Oct. 18, 1988.
 27. "Surface Dynamics with the Infrared Free Election Laser," Workshop on Scientific Opportunities of the Infrared Free Election Laser, Berkeley Conference Center, Berkeley, Calif., Oct. 31, 1988.

28. "Oxidation Kinetics of Silicon Surfaces," Symposium on Chemical Prospectives in Microelectronics, Materials Research Society Fall Meeting, Boston, Mass., Dec. 1, 1988.
29. "Spectroscopy and Diffusion of Molecules on Surfaces Using Laser Induced Thermal Desorption," Molecular Physics Lab Seminar, SRI International, Menlo Park, Calif., Dec. 6, 1988.
30. "Photophysics and Spectroscopy of Surface Adlayers: Pyrene on Al₂O₃(1120)," SPIE Conference on 'Photochemistry in Thin Films,' Los Angeles, Calif., January 18, 1989.
31. "Reaction Kinetics on Si(111)7x7 Studied Using Laser Induced Thermal Desorption," Department of Chemistry, California Institute of Technology, Pasadena, Calif., January 24, 1989.
32. "Reaction Kinetics on Si(111)7x7 Studied Using Laser Induced Thermal Desorption," Department of Chemistry, University of California at San Diego, La Jolla, Calif., January 31, 1989.
33. "Reaction Kinetics on Si(111)7x7 Studied Using Laser Induced Thermal Desorption," Department of Chemistry, University of Texas, Austin, Texas, Feb. 23, 1989.
34. "Reaction Kinetics on Si(111)7x7 Studied Using Laser Induced Thermal Desorption," Department of Chemistry, Texas A & M University, College Station, Texas, Feb. 24, 1989.
35. "Oxidation Kinetics of Silicon Surfaces," Topical Meeting on Microphysics of Surfaces, Beams and Adsorbates, Salt Lake City, Utah, February 27, 1989.
36. "Reaction Kinetics on Si(111)7x7 Studied Using Laser Induced Thermal Desorption," Dept. of Chemistry, Princeton University, Princeton, NJ , March 15, 1989.
37. "Reaction Kinetics on Si(111)7x7 Studied Using Laser Induced Thermal Desorption," Dept. of Chemistry, University of Pennsylvania, Philadelphia, Penn., March 16, 1989.
38. "Reaction Kinetics on Si(111)7x7 Studied Using Laser Induced Thermal Desorption," ATT Bell Laboratories, Murray Hill, NJ , March 17, 1989.
39. "Surface Diffusion of n-Alkanes, Cycloalkanes and Branched Alkanes on Ru(001)," ACS Symposium on Surface Diffusion and Chemical Reactivity of Surfaces, ACS National Meeting, Dallas, Texas, April 10, 1989.
40. "Studies of Reaction Kinetics on Silicon Surfaces Using FTIR," Stanford Materials Research Forum, Dept. of Materials Science and Engineering, Stanford University, Stanford, CA, May 5, 1989.
41. "Surface Diffusion of n-Alkanes, Cycloalkanes and Branched Alkanes on Ru(001)," Symposium on Surface Science and Spectroscopy, Eleventh North American Meeting of the Catalysis Society, Dearborn, Michigan, May 8, 1989

42. "Laser Induced Thermal Desorption Studies of Reaction Kinetics on Si(111) 7x7," International MicroProcess Conference 1989, Kobe, Japan, July 4, 1989.
43. "Photophysics and Energy Transfer on Surfaces: Phenanthrene on Al₂O₃(0001)," ACS Symposium on Surface Photochemistry, ACS National Meeting, Miami Beach, Florida, September 13, 1989.
44. "Reaction Kinetics on Si(111): 7x7 Surfaces Studied Using Laser-Induced Thermal Desorption," Condensed Matter Seminar, Dept. of Physics, Univ. of California, Berkeley, Calif., September 20, 1989.
45. "Surface Diffusion Studies Using Laser-Induced Thermal Desorption," Symposium on Inter- and Intra-Molecular Energy Transfer in Heterogeneous Chemical Processes, Am. Inst. of Chem. Eng. 1989 Annual Meeting, San Francisco, Calif., November 10, 1989.
46. "Photophysics and Energy Transfer on Surfaces: Phenanthrene on Al₂O₃(0001)," Symposium on Surface Photochemistry, International Congress of the Pacific Basin Societies, Honolulu, Hawaii, December 19, 1989.
47. "Surface Kinetics Studied Using Laser-Induced Thermal Desorption," Symposium on Laser Photoionization and Desorption Surface Analysis Techniques, SPIE National Meeting, Los Angeles, Calif., January 18, 1990.
48. "IR Free Electron Laser as a Probe of Vibrational Dynamics on Surfaces," Symposium on Free Electron Lasers and Applications, SPIE National Meeting, Los Angeles, Calif., January 18, 1990.
49. "Diffusion of Physisorbed Molecules on Single-Crystal Surfaces," James Franck Institute, Department of Chemistry, University of Chicago, Chicago, Ill, January 23, 1990.
50. "Diffusion of Physisorbed Molecules on Single-Crystal Surfaces," Physical Chemistry Seminar, Department of Chemistry, University of California, Berkeley, Calif., February 6, 1990.
51. "Diffusion of Physisorbed Molecules on Single-Crystal Surfaces," Dept. of Chemical and Biological Sciences, Oregon Graduate Center, Beaverton, Oregon, February 8, 1990.
52. "Reaction Kinetics on Si(111)7x7 Studied Using Laser-Induced Thermal Desorption," Gordon Research Conference on The Chemistry of Electronic Materials, Ventura, Calif., March 1, 1990.
53. "Diffusion of Physisorbed Molecules on Single-Crystal Surfaces," Symposium on Diffusion on Surfaces, American Physical Society Meeting, Anaheim, Calif., March 13, 1990.
54. "Diffusion of Physisorbed Molecules on Single-Crystal Surfaces," Dept. of Chemistry, University of Southern California, Los Angeles, Calif., April 9, 1990.

55. "Optical Probes of Silicon Surface Chemistry," Session on Thin Films, Interfaces and Epitaxy, Sixth International Symposium on Silicon Materials Science and Technology, 177th Meeting of the Electrochemical Society, Montreal, Quebec, Canada, May 8, 1990.
56. "Diffusion of Physisorbed Molecules on Single-Crystal Surfaces," Department of Chemistry, Univ. of California, Santa Barbara, Calif., May 15, 1990.
57. "Laser Induced Thermal Desorption Studies of Silicon Surface Kinetics," Session on Surface and Microchemistry, International Quantum Electronics Conference, Anaheim, Calif., May 24, 1990.
58. "Laser Induced Thermal Desorption Studies of Silicon Surface Chemistry," Chemistry Division, U.S. Naval Research Laboratory, Washington, D.C., June 14, 1990.
59. "Laser Induced Thermal Desorption Studies of Silicon Surface Chemistry," Chemistry Division, National Institute of Standards and Technology, Gaithersburg, MD, June 15, 1990.
60. "Surface Kinetics Measured Using Laser-Induced Thermal Desorption", Symposium on Laser Processing of Surfaces, Sixth Interdisciplinary Laser Science Conference, Minneapolis, Minnesota, September 19, 1990.
61. "Laser -Induced Desorption Studies of Surface Reaction Kinetics," "Applied Spectroscopy in Material Science," SPIE International Symposium on Laser Spectroscopy, Los Angeles, CA, January 23, 1991.
62. "Diffusion and Reaction Kinetics on Metal and Semiconductor Surfaces," Dept. of Chemical Engineering, Univ. of Colorado, Boulder, Colorado, March 14, 1991.
63. "Reaction Kinetics on Silicon Surfaces," Dept. of Chemistry, Univ. of North Carolina, Chapel Hill, N.C., April 1, 1991.
64. "Surface Diffusion on Single-Crystal Surfaces," Dept. of Chemistry and Biochemistry, Univ. of California, Los Angeles, April 4, 1991.
65. "Reaction Kinetics on Silicon Surfaces," Dept. of Chemistry and Biochemistry, Univ. of California, Los Angeles, April 5, 1991.
66. "Role of Hydrogen in Silicon Surface Chemistry," ACS Symposium on Silicon Hydride Chemistry and Silicon CVD Mechanisms, ACS National Meeting, Atlanta, GA, April 16, 1991.
67. "Hydrogen Desorption Kinetics from Si(111)7x7 and Si(100)2x1," ACS Symposium on Hydrogen in and on Solids, ACS National Meeting, Atlanta GA., April 19, 1991.
68. "Diffusion and Reaction Kinetics on Metal and Semiconductor Surfaces," Dept. of Chemistry and Biochemistry, Univ. of California, San Diego, Calif., April 22, 1991.

69. "Diffusion and Reaction Kinetics on Metal and Semiconductor Surfaces", Dept. of Physics, Univ. of California at Riverside, Riverside, Calif., April 30, 1991.
70. "Surface Diffusion on Single-Crystal Metal Surfaces", Pennsylvania Surface Science Workshop, Lehigh University, Bethlehem, PA, July 17, 1991.
71. "Diffusion on Stepped Single-Crystal Ru(001) Surfaces", Dynamics of Molecule-Surface Interactions, SERC/NSF Joint Workshop for Young Chemists, University of Liverpool, Liverpool, England, July 24, 1991.
72. "Adsorption and Decomposition of Diethylsilane on Silicon Surfaces," Dept. of Chemistry, University of Texas, Austin TX, August 22, 1991.
73. "Electronic Energy Transfer Between Donor and Acceptor Adlayers on Single-Crystal Surfaces", Symposium on Energy Transfer and Relaxation in Condensed Phases, National ACS Meeting, New York, NY, August 27, 1991.
74. "Semiconductor Surface Chemistry", Dept. of Chemistry and Biochemistry, University of Colorado, Boulder, CO, September 3, 1991.
75. "Diffusion on Stepped Single-Crystal Surfaces", Molecular Sciences Laboratory, Batelle Pacific Northwest Laboratories, Richland, WA, September 11, 1991.
76. "Laser-Induced Desorption Studies of Surface Reaction Kinetics", Seventh Interdisciplinary Laser Science Conference, Monterey, Calif., September 24, 1991.
77. "Diffusion on Single-Crystal Surfaces", Dept. of Chemistry, San Francisco State University, San Francisco, Calif, October 11, 1991.
78. "Surface Diffusion on Stepped Single-Crystal Metal Surfaces", First U.S.-Japan Workshop for Young Scientists in Molecular Sciences, Institute for Molecular Science, Okasaki, Japan, October 24, 1991.
79. "Kinetics of Silicon Growth Using Chlorosilanes and Alkylsilanes," Surface Science Symposium on Semiconductor Surfaces, AVS National Meeting, Seattle, Washington, November 12, 1991.
80. "Adsorption and Decomposition Kinetics of Alkylsilanes on Silicon Surfaces Using Laser Induced Desorption and FTIR Techniques," International Workshop on Science and Technology for Surface Reaction Processes, Tokyo, Japan, January 24, 1992.
81. "Surface Diffusion on Single-Crystal Surfaces," Dept. of Chemistry, Cornell University, Ithaca, N.Y., April 2, 1992.
82. "Surface Diffusion on Single-Crystal Metal Surfaces," Dept. of Physics, University of California, Davis, Calif., April 9, 1992.
83. "Electronic Energy Transfer Between Model Donor and Acceptor Adlayers," Symposium

- on Surface Photochemistry, ACS National Meeting, San Francisco, Calif., April 10, 1992.
84. "Adsorption and Decomposition of Alkylsilanes and Alkylgermanes on Silicon Surfaces," 75th Canadian Chemical Conference, Edmonton, Alberta, June 1, 1992.
 85. "Silicon Surface Chemistry: Controlled Growth to Photoluminescence," Dept. of Electrical Engineering, Univ. of Rochester, Rochester, NY, Aug. 12, 1992.
 86. "Surface Chemistry of Silicon Epitaxial Growth with Chlorosilanes and Alkylsilanes," Symposium on Advances in High-Temperature Interface Chemistry, Electrochemical Chemical Society Meeting, Toronto, Ontario, Oct. 12, 1992.
 87. "Adsorption and Decomposition of Alkylsilanes and Alkylgermanes on Silicon Surfaces," Dept. of Chemistry, Univ. of Missouri-Columbia, Columbia, MO, Oct. 16, 1992.
 88. "Silicon Surface Chemistry: Controlled Growth to Photoluminescence," National Renewable Energy Laboratory, Golden, CO, Nov. 5, 1992.
 89. "Chemistry and Kinetics of Si and SiO₂ Deposition on Silicon Surfaces," Surface Science and Catalysis Seminar, Lawrence Berkeley Laboratory, Univ. of California, Berkeley, CA, March 4, 1993.
 90. "Controlled Growth of SiO₂ By Atomic Layer Processing," Symposium on Molecular Processes on Solid Surfaces, American Chemical Society Meeting, Denver, CO, March 31, 1993.
 91. "Surface Chemistry for Controlled Growth of SiO₂ on Silicon Surfaces," Materials Technology Department, Intel Corporation, Santa Clara, CA, April 13, 1993.
 92. "Surface Chemistry for Controlled Growth of SiO₂ on Silicon Surfaces," Sandia National Laboratories, Albuquerque, NM, May 20, 1993.
 93. "Chemistry of SiH₂Cl₂ on Silicon Surfaces: Adsorption Species, Desorption Kinetics and Modeling of Si CVD Growth", Committee on Atomic Order Processing, Organized by the Japan Society for the Promotion of Science, Yotsuya, Tokyo, JAPAN, July 7, 1993.
 94. "Chemistry of SiH₂Cl₂ on Silicon Surfaces", ULSI Research Center, Hitachi Central Research Laboratory, Kokubunji, Tokyo, JAPAN, July 8, 1993.
 95. "Chemistry of SiH₂Cl₂ on Silicon Surfaces", ULSI Laboratory, Mitsubishi Electric Corporation, Itami, Osaka, JAPAN, July 9, 1993.
 96. "Chemistry of SiH₂Cl₂ on Silicon Surfaces: Adsorption Species, Desorption Kinetics and Modeling of Si CVD Growth", Dept. of Electrical Engineering, Hiroshima University, Higashi-Hiroshima, JAPAN, July 26, 1993.
 97. "Surface Science Studies on MgO(100) and SiO₂ Surfaces", Symposium on Physical

- Chemistry and the Environment, Physical Chemistry Division, National American Chemical Society Meeting, Chicago, Illinois, August 23, 1993.
98. "Surface Chemistry on Porous Silicon Using Transmission FTIR Spectroscopy", Symposium on Vibrational Spectroscopy at Surfaces, Colloid and Surface Chemistry Division, National American Chemical Society Meeting, Chicago, Illinois, August 24, 1993.
 99. "Surface Science Studies of Environmental Interfaces", Analytical and Environmental Chemistry Seminar, Dept. of Chemistry, Univ. of Colorado, Boulder, Colorado, August 31, 1993.
 100. "Surface Spectroscopy and Dynamics Measured Using Laser Induced Desorption Experiments", Workshop on Surface Dynamical Growth Processes, Vanderbilt University, Nashville, Tennessee, Oct. 29, 1993.
 101. "Surface Chemistry for Atomic Layer Control of Si and SiO₂ Deposition", Division of Electronic Materials Session on *Chemical Routes to Group IV Epitaxy*, 40th National American Vacuum Society Symposium, Orlando, Florida, Nov. 15, 1993.
 102. "Surface Chemistry of Semiconductor Processing", Departmental Colloquium, Dept. of Chemistry, Purdue University, West Lafayette, Indiana, Nov. 18, 1993.
 103. "Characterization of Model Polar Stratospheric Cloud Films Using Laser Induced Thermal Desorption and Optical Interference Techniques" in Technical Session on *Laser Techniques for Surface Science*, OE/LASE '94 SPIE International Symposium, Los Angeles, Calif., Jan. 27, 1994.
 104. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", Materials Technology Department, Intel Corporation, Santa Clara, CA, May 16, 1994.
 105. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", Chevron Research and Technology Company, Richmond, CA, May 17, 1994.
 106. "Chemistry of SiH₂Cl₂ on Silicon Surfaces: Adsorption Species, Desorption Kinetics and Modeling of Si CVD Growth", Silicon Symposium, National Electrochemical Society Meeting, San Francisco, California, May 24, 1994
 107. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", 3rd International Symposium on Atomic Layer Epitaxy and Related Surface Processes (ALE-3), Sendai, Japan, May 26, 1994.
 108. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", LSI Basic Research Laboratory, NEC Microelectronics Research Laboratories, Tsukuba, Japan, May 30, 1994.

109. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", ULSI Process Laboratory, Fujitsu Laboratories, Atsugi, Japan, May 31, 1994.
110. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", Crystalline Physics Laboratory, Dept. of Electrical Engineering, Hiroshima University, Higashi-Hiroshima, Japan, June 11, 1994.
111. "Dynamics, Optical Characterization, and Surface Chemistry of Ice and Nitric Acid Hydrate Films", Gordon Research Conference on "Interaction of H₂O with Solid Surfaces", Plymouth State College, Plymouth, New Hampshire, July 19, 1994.
112. "Optical Characterization and Dynamics of Ice and Nitric Acid Hydrate Films", Telluride Workshop on *Chemical Physics and the Atmosphere*, Telluride, Colorado, August 3, 1994.
113. "Synthesis of Molecular-Sieving Alumina Membranes by Atomic Layer Controlled Chemical Vapor Deposition", Separation Research Seminar, Chevron Research and Technology Company, Richmond, California, September 19, 1994.
114. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", Dept. of Chemistry, University of South Dakota, Vermillion, South Dakota, September 26, 1994.
115. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", Dept. of Chemistry, Columbia University, New York, New York, October 4, 1994.
116. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", Chemistry Division, Brookhaven National Laboratory, Upton, New York, October 5, 1994.
117. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", Dept. of Chemistry, Rutgers University, Piscataway, New Jersey, October 6, 1994.
118. "Atomic Layer Controlled Deposition of SiO₂ and Al₂O₃ Using ABAB... Binary Reaction Sequence Chemistry", *Distinguished TCU Research Fund Lecture*, Dept. of Chemistry, Texas Christian University, Fort Worth, Texas, November 8, 1994.
119. "Thermal Chemistry for Atomic Layer Controlled Growth on Silicon Surfaces", Gordon Conference on *Excitation at Semiconductor Surfaces- Fundamental Concepts and Applications in Semiconductor Processing*, Hilton Hotel, Turtle Bay, Oahu, Hawaii, November 15, 1994.
120. "Atomic Layer Controlled Deposition Using Binary Reaction Sequence Chemistry", Dept. of Chemistry, University of Wisconsin, Madison, Wisconsin, February 23, 1995.

121. "Atomic Layer Controlled Deposition Using of SiO₂ and Al₂O₃ Binary Reaction Sequence Chemistry", Dept. of Chemistry, Calif. Inst. of Technol., Pasadena, California, March 6, 1995.
122. "Atomic Layer Controlled Deposition Using Binary Reaction Sequence Chemistry", Dept. of Chemistry, Univ. of Minnesota, Minneapolis, Minnesota, May 1, 1995.
123. "Atomic Layer Control of the Chemical Vapor Deposition of Ultrathin Diffusion Barriers in Electrochromic Devices", Colorado Advanced Materials Institute (CAMI) Meeting, Phipps Conference Center, Univ. of Denver, Denver, Colorado, May 4, 1995.
124. "Atomic Layer Controlled Deposition of Dielectric Films Using Binary Reaction Sequence Chemistry", Components Research Division, Intel Corporation, Santa Clara, California, July 24, 1995.
125. "Atomic Layer Control of Thin Film Growth Using Binary Reaction Sequence Chemistry", Dept. of Chemistry, Southern Illinois University, Carbondale, Illinois, Sept. 15, 1995.
126. "Atomic Layer Controlled Deposition Using Binary Reaction Sequence Chemistry", The Third International Symposium on Atomically Controlled Surfaces and Interfaces, North Carolina State University, Raleigh, North Carolina, October 13, 1995
127. "Hydroxylation and Dehydroxylation of Aluminum Oxide Surfaces", Symposium on the *Impact of Rockets on the Stratosphere*, TRW Space & Technology Division, TRW, Redondo Beach, Calif., May 20, 1996.
128. "Dynamic Ice Surface in the Polar Stratosphere", International Meeting on *Surface Science: Critical Review and Outlook*, Univ. of Hong Kong, Hong Kong, June 11, 1996.
129. "Atomic Layer Control of Thin Film Growth Using Binary Reaction Sequence Chemistry", Advanced Structures and Materials Group, Lockheed-Martin, Denver, Colorado, June 27, 1996.
130. "Al₂O₃ and In₂O₃ Films Grown Using Atomic Layer Deposition Techniques: Effect of Surface Coverage", International Meeting on *Atomic Layer Epitaxy and Related Surface Processes (ALE-4)*, Johannes Kepler University, Linz, Austria, July 30, 1996.
131. "Atomic Layer Growth of Thin Films Using Binary Reaction Sequence Chemistry", Dept. of Chemistry, Colorado State University, September 18, 1996.
132. "Dynamic Ice Surface in the Polar Stratosphere", Dept. of Chemistry, Univ. of Pittsburg, Pittsburg, Pennsylvania, October 31, 1996.
133. "Atomic Layer Controlled Deposition Using Binary Reaction Sequence Chemistry", International Symposium on *Surface Nano-Control of Environmental Catalysts and Related Materials*, 6th Iketani Conference, Waseda University, Tokyo, Japan, November 27, 1996.

134. "Atomic Layer Controlled Growth Using Binary Reaction Sequence Chemistry", Dept. of Chemistry, University of Oregon, December 2, 1996.
135. "Atomic Layer Controlled Growth Using Binary Reaction Sequence Chemistry", Dept. of Chemistry, Oregon State University, December 3, 1996.
136. "Atomic Layer Controlled Growth Using Binary Reaction Sequence Chemistry", Chemistry, Energy and Materials Division, SRI International, Menlo Park, California, January 28, 1997.
137. "Modification of Ceramic Membranes Using Binary Reaction Sequence Chemistry", Chevron Research and Engineering Company, Richmond, California, January 29, 1997.
138. "Dynamic Ice Surface in the Polar Stratosphere", Surface Science Seminar, Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Univ. of California, Berkeley, California, January 30, 1997.
139. "Atomic Layer Growth Using Binary Reaction Sequence Chemistry", Symposium Honoring the Memory of Brian Bent, National American Chemical Society, San Francisco, California, April 13, 1997.
140. "Atomic Layer Controlled Growth of Ultrathin Silicon Nitride Diffusion Barriers in Thin Film Devices", Colorado Advanced Materials Institute Meeting, Denver, Colorado, May 8, 1997.
141. "Atomic Layer Deposition of SiO_2 , Al_2O_3 and Si_3N_4 ", Optical Electronics Center, Lucent Technologies, Bell Labs, Breinigsville, Pennsylvania, June 20, 1997.
142. "Adsorption and Desorption of H_2O from $\alpha\text{-Al}_2\text{O}_3(0001)$ ", Symposium on Heterogeneous and Homogeneous Processes in Atmospheric Chemistry, National American Chemical Society Meeting, Las Vegas, Nevada, September 8, 1997.
143. "Atomic Layer Control of Thin Film Growth", Joint Research Center for Atom Technology (JRCAT) Workshop on "Science and Technology of Hydrogen-Terminated Silicon Surfaces", Tsukuba, Japan, November 5, 1997.
144. "Atomic Layer Growth Using Binary Reaction Sequence Chemistry", Symposium on Dynamics and Chemistry of Thin Film Growth, Fifth Chemical Congress of North America, Cancun, Quintana Roo, Mexico, November 15, 1997.
145. "Adsorption and Desorption of H_2O from $\alpha\text{-Al}_2\text{O}_3(0001)$ ", Air Force Workshop on Atmospheric Effects of Rocket Exhaust, Beckman Center, Univ. of California, Irvine, California, January 9, 1998.
146. "Atomic Layer Control of Thin Film Growth Using Sequential Surface Reactions", Electronic Materials Laboratory, National Renewable Energy Lab (NREL), Golden, Colorado, February 19, 1998.

147. "Atomic Layer Growth Using Sequential Surface Reactions", Technical Excellence Seminar Series, Advanced Micro Devices (AMD), Sunnyvale, California, February 24, 1998.
148. "Atomic Layer Control of Thin Film Growth Using Sequential Surface Reactions", Division of Materials Research, United States Dept. of Energy (DOE), Germantown, Maryland, February 27, 1998.
149. "Diffusion and Desorption Kinetics on Ice", Symposium on Interfacial Water, Physical Chemistry Division, 215th National Meeting of the American Chemical Society, Dallas, Texas, March 31, 1998.
150. "Atomic Layer Deposition of Thin Films Using Sequential Surface Reactions", Soft Condensed Matter Seminar, Dept. of Physics, University of Colorado, Boulder, Colorado, April 16, 1998.
151. H₂O Adsorption and Desorption Kinetics on α -Al₂O₃(0001)", Air Force Office of Scientific Research, Molecular Dynamics Review, Naval Postgraduate School, Monterey, California, May 18, 1998.
152. "Atomic Layer Deposition Using Sequential Surface Reactions", 81st Canadian Society for Chemistry Conference, Session on Structure and Dynamics at Surfaces and Interfaces, Whistler, British Columbia, June 3, 1998.
153. "Atomic Layer Controlled Growth of Thin Films Using Sequential Surface Reactions", Dept. of Chemistry, University of Iowa, September 4, 1998.
154. "Atomic Layer Deposition of WN Using Sequential Surface Reactions", Genus, Inc., Sunnyvale, California, September 10, 1998.
155. "SiO₂ Deposition on BN Particles", Center for Micro-Engineered Materials, Univ. of New Mexico, Albuquerque, New Mexico, September 15, 1998.
156. "Surface Chemistry of Atomic Layer Controlled Growth", Workshop on the Chemistry and Applications of Atomic Layer Epitaxy, Neste Corporation, Espoo, Finland, September 28, 1998.
157. "Deposition of Conformal Atomic Layer Controlled Films on High Aspect Ratio Substrates", Workshop on the Chemistry and Applications of Atomic Layer Epitaxy, Neste Corporation, Espoo, Finland, September 28, 1998.
158. "Atomic Layer Deposition of Silicon Nitride", Neste Surface Chemistry Laboratory, Neste Corporation, Espoo, Finland, September 30, 1998.
159. "Atomic Layer Deposition of Thin Films Using Sequential Surface Reactions", Midwest Regional American Chemical Society Meeting, Symposium on Surface Science: What Can We Learn From Model Systems, Wichita, Kansas, November 5, 1998.

160. "Atomic Layer Deposition of Thin Films Using Sequential Surface Reactions", Dept. of Chemical and Environmental Engineering and the Engineering Research Center for Environmentally Benign Semiconductor Manufacturing, Univ. of Arizona, Tucson, Arizona, December 7, 1998.
161. "Atomic Layer Control of Thin Film Growth Using Sequential Surface Reactions", Dept. of Chemistry, Univ. of Utah, Salt Lake City, Utah, February 8, 1999.
162. "Atomic Layer Control of Thin Film Growth Using Sequential Surface Reactions", *Class of 1960 Seminar Speaker*, Dept. of Chemistry, Williams College, Williamstown, Massachusetts, March 12, 1999.
163. "The Dynamic Ice Surface", Chemical Physics Seminar, Dept. of Chemistry, University of Colorado, Boulder, Colorado, April 23, 1999.
164. "Ultrathin Insulators for Tape Head Applications Using Atomic Layer Controlled Growth Techniques", Colorado Advanced Materials Institute Meeting, University of Denver, Denver, Colorado, May 6, 1999.
165. "Atomic Layer Deposition of Ultrathin Films Using Sequential Surface Reactions", Seminar to *Seagate Recording Heads Group*, Seagate Technology, Bloomington, Minnesota, July 29, 1999.
166. "Tungsten and Tungsten Nitride Atomic Layer Deposition Using Sequential Surface Reactions", Nanoelectronics Seminar, The Institute of Physical and Chemical Research (RIKEN), Wakao, Saitama, Japan, August 23, 1999.
167. "Tungsten and Tungsten Nitride Atomic Layer Deposition Using Sequential Surface Reactions", Dept. of Electrical and Electronic Engineering, Tokyo Institute of Technology, Tokyo, Japan, August 24, 1999.
168. "FTIR Studies of Tungsten and Tungsten Nitride Atomic Layer Deposition Using Sequential Surface Reactions", Session on Semiconductor Surfaces and Interfaces, *Twelfth International Conference on Fourier Transform Spectroscopy*, Waseda University, Tokyo, Japan, August 26, 1999.
169. "The Dynamic Ice Surface and Diffusion in Ice", Dept. of Chemistry, Cambridge University, Cambridge, England, November 15, 1999.
170. "The Dynamic Ice Surface and Diffusion in Ice", Laboratoire de Physique des Lasers, Atomes et Molecules, Unite Mixte de Recherche CNRS, University of Lille, Lille, France, November 17, 1999.
171. "The Dynamic Ice Surface and Diffusion in Ice", Laboratoire de Glaciologie et Geophysique de l'Environnement, CNRS, University of Grenoble, Grenoble, France, November 18, 1999.
172. "The Dynamic Ice Surface and Diffusion in Ice", Dept. of Physique, Faculte des Sciences

de Luminy, CRMC2-CNRS, Marseille, France, November 19, 1999.

173. "Atomic Layer Deposition of Thin Films and Nanolaminates", X-Ray Diffraction Workshop, Dept. of Physics, University of Colorado, Boulder, Colorado, March 17, 2000.
174. "Atomic Layer Deposition of Tungsten on Oxide Surfaces", Colloid and Surface Chemistry Division Symposium on *Semiconductor Surface Chemistry: Reactions Involving Metals*, 219th American Chemical Society National Meeting, San Francisco, California, March 27, 2000.
175. "FTIR Studies of the Atomic Layer Deposition of Barrier Seeds Using Sequential Surface Reactions", Honeywell, Electronic Materials and Interconnect Solutions Group, Sunnyvale, California, March 28, 2000.
176. "Atomic Layer Deposition of Nitrides, Metals and Oxides Using Sequential Surface Reactions", IBM T.J. Watson Research Center, Yorktown Heights, New York, April 13, 2000.
177. "Atomic Layer Deposition of Thin Films Using Sequential Surface Reactions", Steacie Institute for Molecular Sciences, National Research Council, Ottawa, Canada, April 14, 2000.
178. "Atomic Layer Deposition of Thin Films Using Sequential Surface Reactions", Symposium on *Novel Methods, Mechanisms and Models of Vapor Deposition*, Materials Research Society Meeting, San Francisco, California, April 25, 2000.
179. ""Atomic Layer Deposition of Thin Films Using Sequential Surface Reactions", Applied Materials, Santa Clara, California, June 8, 2000.
180. "Diffusion in Ice Measured by Laser Resonant Desorption", *Physics and Chemistry of Liquid-Like Layers in the Environment*, EMSL2000, William R. Wiley Environmental Molecular Sciences Laboratory, Pacific Northwest National Laboratory, Richland, Washington, June 22, 2000.
181. ""Diffusion in Ice Measured by Infrared Laser Resonant Desorption", Telluride Summer Research Center Workshop on *Water in Confined Geometries*, Telluride, Colorado, August 1, 2000.
182. "Atomic Layer Deposition of Ultrathin Films Using Sequential Surface Reactions", Annual Retreat of the *NSF/SRC Engineering Research Center on Environmentally Benign Semiconductor Manufacturing*, Stanford University, Stanford, California, August 9, 2000.
183. "Atomic Layer Epitaxy", 27th Annual Symposium of the Rocky Mountain Chapter of the American Vacuum Society, Avada, Colorado, August 24, 2000.
184. "Atomic Layer Deposition of Ultrathin Films Using Sequential Surface Reactions", Dept. of Chemistry, University of New Mexico, Albuquerque, New Mexico, September 8, 2000.

185. "Atomic Layer Deposition of Ultrathin Films Using Sequential Surface Reactions", Patten Lecture, Dept. of Chemical Engineering, University of Colorado, Boulder, Colorado, September 19, 2000.
186. "Tungsten Atomic Layer Deposition: Nucleation and Growth on Oxide Surfaces", Thin Films Division Session on *Atomic Layer Deposition*, 47th International Symposium of the American Vacuum Society, Boston, Massachusetts, October 2, 2000.
187. "Atomic Layer Deposition of Ultrathin Films Using Sequential Surface Reactions", Dept. of Chemistry and Chemical Biology, Harvard University, Cambridge, Massachusetts, October 5, 2000.
188. "Atomic Layer Deposition of Thin Films Using Sequential Surface Reactions", Air Force Research Laboratory, Materials and Manufacturing Directorate, Wright-Patterson Air Force Base, Dayton, Ohio, October 17, 2000.
189. "Atomic Layer Deposition of Ultrathin Films Using Sequential Surface Reactions", Dept. of Chemistry, University of North Carolina, Chapel Hill, North Carolina, November 2, 2000.
190. "Atomic Layer Deposition of Ultrathin Films Using Sequential Surface Reactions", 31st Semiconductor Interface Specialists Conference, Catamaran Resort, San Diego, California, December 9, 2000.
191. "Thin Films Grown Using Atomic Layer Epitaxy Methods for Magnetic Recording Head Manufacturing", University Research Conclave II, Seagate Technology, Bloomington, Minnesota, December 11, 2000.
192. "Atomic Layer Deposition of Tungsten on Oxide Surfaces Using Sequential Surface Reactions", Second International Workshop on Oxide Surfaces (IWOX-2), Quail Ridge Inn, Taos, New Mexico, Jan. 16, 2001.
193. "Atomic Layer Deposition of Thin Films Using Sequential Surface Reactions", Dept. of Chemistry, Montana State University, Bozeman, Montana, Jan. 26, 2001.
194. "Atomic Layer Deposition of Metallic Films: Tungsten and Titanium Nitride", Second International American Vacuum Society Conference on Microelectronics and Interfaces, Santa Clara, California, Feb. 8, 2001.
195. "Diffusion in Ice Measured Using Laser Resonant Desorption", Session on *Dynamics at Surfaces: Liquids and Ices*, March Meeting of the American Physical Society, Seattle, Washington, March 14, 2001.
196. "Atomic Layer Deposition of Al₂O₃, ZnO and Al₂O₃/ZnO Nanolaminates Using Sequential Surface Reactions in a Viscous Flow Reactor", Session on *Thin Films: Preparation, Characterization, Applications*, 221st National Meeting of the American Chemical Society, San Diego, California, April 3, 2001.

197. "Nucleation and Growth During Tungsten Atomic Layer Deposition on Oxide Surfaces", Session on *Mechanisms of Surface and Microstructure Evolution in Deposited Films and Film Structures*, Materials Research Society Meeting, San Francisco, California, April 19, 2001.
198. "Atomic Layer Deposition of Tungsten Using Sequential, Self-Limiting Surface Reactions", Tungsten Products Division, Novellus Systems, Inc., San Jose, California, April 17, 2001.
199. "Atomic Layer Deposition of ZnO/Al₂O₃ Nanolaminates and Alloys", Core Technologies, Applied Materials, Santa Clara, California, April 17, 2001.
200. "Atomic Layer Deposition Using Sequential, Self-Limiting Surface Reactions", Applied Films Corporation, Longmont, California, October 4, 2001.
201. "Tungsten Atomic Layer Deposition Using Sequential, Self-Limiting Surface Reactions", Dept. of Materials Chemistry, Uppsala University, Uppsala, Sweden, October 18, 2001.
202. "Atomic Layer Deposition of ZnO/Al₂O₃ Nanolaminates and Alloys", Extended UltraViolet Lithography (EUVL) Group, Lawrence Livermore National Laboratory, Livermore, California, December 20, 2001.
203. "Atomic Layer Deposition of Al₂O₃/ZnO Nanolaminates & Alloys", Dept. of Chemistry, Yale University, New Haven, Connecticut, February 5, 2002.
204. "Surface Chemistry of the Atomic Layer Deposition of TiN and Cu Barrier Seeds", Packaging and Interconnect Symposium, University of Illinois, Champaign, Illinois, March 6, 2002.
205. "Surface Chemistry and Thin Film Growth During TiN Atomic Layer Deposition Using TDMAT and NH₃", Components Research, Intel Corporation, Hillsboro, Oregon, May 7, 2002.
206. "Nucleation of TiN ALD on Low k Polymer Dielectrics", Components Research, Intel Corporation, Hillsboro, Oregon, May 7, 2002.
207. "Atomic Layer Deposition of Al₂O₃/ZnO Nanolaminates and Alloys: Fabrication and Properties", 38th Annual Symposium of the New Mexico Chapter of the American Vacuum Society, Wyndham Albuquerque Hotel, Albuquerque, New Mexico, May 15, 2002.
208. "Atomic Layer Deposition Using Sequential, Self-limiting Surface Reactions", Advanced Energy Corporation, Ft. Collins, Colorado, July 9, 2002.
209. "Atomic Layer Deposition of Al₂O₃/ZnO Nanolaminates and Alloys", Surface Engineering with Ceramics, CIMTEC 2002 International Conferences on Modern Materials & Technologies, 10th International Ceramics Conference, Florence, Italy, July 16, 2002.

210. "Atomic Layer Deposition Using Sequential, Self-limiting Surface Reactions", Applied Materials Corporation, Santa Clara, California, August 6, 2002.
211. "Hafnium and Silicon Amido Complexes for ALD of High-k Gate Dielectrics", Applied Materials Corporation, Santa Clara, California, August 6, 2002.
212. "In Situ Probing of Atomic Layer Deposition in Viscous Flow Reactors", American Vacuum Society Topical Conference on Atomic Layer Deposition (ALD 2002), Hanyang Institute of Technology, Hanyang University, Seoul, Korea, August 20, 2002.
213. "Atomic Layer Deposition for Thin Film Growth", Analytical Seminar, Dept. of Chemistry and Biochemistry, University of Colorado, Boulder, Colorado, September 23, 2002.
214. "Thin Film Growth Using Atomic Layer Deposition", Chemical Physics Seminar, Dept. of Chemistry and Biochemistry, University of Colorado, Boulder, Colorado, September 27, 2002.
215. "Thin Film Growth Using Atomic Layer Deposition", Dept. of Chemical Engineering, North Carolina State University, Raleigh, North Carolina, October 7, 2002.
216. "SiO₂ Atomic Layer Deposition Catalyzed by Lewis Bases", The Fifth Baltic Symposium on Atomic Layer Deposition, University of Tartu, Tartu, Estonia, October 24, 2002.
217. "Thin Film Growth Using Atomic Layer Deposition", Corporate Research and Development, The Dow Chemical Company, Midland, Michigan, November 11, 2002.
218. "Atomic Layer Deposition for Improved MEMS Reliability", Thin Film, Vacuum, and Packaging Department, Sandia National Laboratories, Albuquerque, New Mexico, January 16, 2003.
219. "Atomic Layer Deposition on Fine Particles", Ferro Electronic Materials Systems, Penn Yan, New York, February 10, 2003.
220. "Atomic Layer Deposition for Conformal Coating of High Aspect Ratio Structures", ICMI 2003 – Fourth International Conference on Microelectronics and Interfaces, American Vacuum Society, Santa Clara Convention Center, Santa Clara, California, March 4, 2003.
221. "Thin Film Growth Using Atomic Layer Deposition", Optoelectronic Computing Systems Seminar, Dept. of Electrical and Computer Engineering, University of Colorado, Boulder, Colorado, April 11, 2003.
222. "Fabricating Energetic SuperThermite Particles Using Atomic Layer Deposition Techniques", Technanogy, LLC, Santa Ana, California, May 19, 2003.
223. "Optimizing and Understanding Semiconductor Gas Sensors Using Atomic Layer Deposition Techniques", Nanomaterials Research LLC, Longmont, Colorado, May 23, 2003.

224. "Thin Film Growth Using Atomic Layer Deposition Techniques", Sporian Microsystems, Boulder, Colorado, May 27, 2003.
225. "Fabrication and Properties of Al₂O₃/W Nanolaminates Using Atomic Layer Deposition", ALD Symposium, Sandia National Laboratories, Albuquerque, New Mexico, July 28, 2003.
226. "Low Temperature Atomic Layer Deposition", Northern California American Vacuum Society *Thin Films 2003 Annual Symposium*, Silicon Valley Conference Center, San Jose, California, September 30, 2003.
227. "Atomic Layer Deposition on Polymers", Vitex Systems, Inc., San Jose, California, October 1, 2003.
228. "Low Temperature Atomic Layer Deposition", Genus, Inc., Sunnyvale, California, October 1, 2003.
229. "Incorporation and Control of Silica in Hafnium Silicates Using Atomic Layer Deposition Techniques", Genus, Inc., Sunnyvale, California, October 1, 2003.
230. "Atomic Layer Deposition for Thin Film Growth", Analytical Chemistry Division Seminar, Dept. of Chemistry and Biochemistry, University of Colorado, Boulder, Colorado, October 6, 2003.
231. "Atomic Layer Deposition of Metals", Advanced Metallization Conference (AMC) 2003, Workshop on *Atomic Layer Deposition- Key Enabler for Sub-100nm IC Technology*, Montreal, Canada, October 20, 2003.
232. "Introduction to Atomic Layer Deposition", Honeywell, Specialty Chemicals, Buffalo, New York, January 19, 2003.
233. "Low Temperature Atomic Layer Deposition", Honeywell, Specialty Chemicals, Buffalo, New York, January 19, 2003.
234. "Atomic Layer Deposition of Metals", Honeywell, Specialty Chemicals, New York, January 19, 2003.
235. "Thin Film Growth Using Atomic Layer Deposition", *Surface Science 2004: 2nd Annual University of California Symposium on Surface Science and its Applications*, Department of Chemistry, University of California at San Diego, La Jolla, California, February 20, 2004.
236. "Al₂O₃ Atomic Layer Deposition on Polymers", Symposium on Polymers in Micro- and Nano-electronics, Division of Polymeric Materials, 227th American Chemical Society National Meeting, Anaheim, California, March 31, 2004.
237. "Thin Film Growth Using Atomic Layer Deposition", *Engineering Leading Edge Program*, Micron Technology, Inc., Boise, Idaho, May 14, 2004.

238. "Thin Film Growth Using Atomic Layer Deposition", Department of Chemistry, University of Florida, Gainesville, Florida, July 6, 2004.
239. "Fabrication and Properties of Al₂O₃/W Nanolaminates Prepared Using Atomic Layer Deposition Techniques", Annual Symposium of the Rocky Mountain American Vacuum Society, Ben Parker Student Center, Colorado School of Mines, Golden, Colorado, August 12, 2004.
240. "Atomic Layer Deposition on Polymers", American Vacuum Society Topical Conference on Atomic Layer Deposition (ALD2004), University of Helsinki, Helsinki, Finland, August 17, 2004.
241. "Nanofabrication of Novel Structures for Optical Applications Using Atomic Layer Deposition", Analytical Chemistry Seminar, Dept. of Chemistry and Biochemistry, University of Colorado, Boulder, Colorado, October 4, 2004.
242. "Surface Chemistry and Film Growth during ZnO Atomic Layer Deposition", *Topical Conference on Science of Semiconductor White Light*, 51st International AVS Symposium, Anaheim, California, November 17, 2004.
243. "Atomic Layer Deposition of Thin Films for Thermal, Optical and Diffusion Barrier Applications", 2004 Discovery Chemistry Seminar, DuPont Central Research and Development, Wilmington, Delaware, December 15, 2004.
244. "Fabrication and Properties of Thin Films Grown Using Atomic Layer Deposition Techniques", Colorado American Chemical Society (ACS) Section Award Talk, ACS Section Meeting, Aspen Room, CU Memorial Center, January 18, 2005.
245. "Atomic Layer Deposition of Metals", Dept. of Chemistry, University of Helsinki, Helsinki, Finland, April 8, 2005.
246. "Atomic Layer Deposition on Polymers", S.M. George, 48th Annual Society of Vacuum Coaters Technical Conference and Smart Materials Symposium, Denver, Colorado, April 27, 2005.
247. "SiO₂ Thin Films Grown Using Atomic Layer Deposition Techniques", 38th Silicon Symposium, University of Colorado, Boulder, Colorado, June 2, 2005.
248. "Scaleup of Atomic Layer Deposition for Coating Large Quantities of Particles", Ferro Electronic Material Systems, Penn Yan, New York, June 16, 2005.
249. "Atomic Layer Deposition on Polymers", Fifteen European Conference on Chemical Vapor Deposition (EUROCVD-15), Bochum, Germany, September 5, 2005.
250. "Atomic Layer Deposition on Polymers", Analytical Chemistry Division Seminar, Department of Chemistry and Biochemistry, University of Colorado, September 19, 2005.
251. "Al₂O₃ ALD as a Model ALD System", Division of Materials Science and Engineering,

- Hanyang University, Seoul, Korea, October 4, 2005.
252. "Atomic Layer Deposition on Polymers", SKC Co., Ltd., Seoul, Korea, October 4, 2005.
 253. "Atomic Layer Deposition on Polymers", Korea Research Institute of Chemical Technology (KRICT), Daejeon, Korea, October 5, 2005.
 254. "SiO₂ Thin Films Grown Using ALD Techniques", ASM-Genitech, Daejeon, Korea, October 5, 2005.
 255. "SiO₂ Thin Films Grown Using ALD Techniques", Samsung Electronics Co., Ltd., Yongin-City, Gyeonggi-Do, Korea, October 6, 2005.
 256. "Enhanced ALD Using Radicals and Catalysts", 2005 Tera Level Nanodevices (TND), Ministry of Science and Technology (MOST), Korean Science and Technology Center, Seoul, Korea, October 7, 2005.
 257. "Atomic Layer Deposition on Polymers", College of Natural Sciences, Kookmin University, Seoul, Korea, October 8, 2005.
 258. "ALD of W/Al₂O₃ Nanolaminates: Applications and Challenges", 208th Meeting of the Electrochemistry Society (ECS), Symposium on ALD Applications: Challenges and Opportunities, Westin Bonaventure, Los Angeles, California, October 18, 2005.
 259. "Thin Film Growth Using Atomic Layer Deposition Techniques", Department of Chemistry, Michigan State University, East Lansing, Michigan, March 9, 2006.
 260. "Enhanced Thermite Materials by Atomic Layer Deposition of Metal Oxides on Aluminum Nanoparticles", *Second Eglin Symposium on NanoEnergetics (ESNE2)*, Research, Engineering and Education Facility (REEF) of the University of Florida, Shalimar, Florida, March 22, 2006.
 261. "Fabrication and Properties of Al₂O₃/W Nanolaminates Prepared Using Atomic Layer Deposition Techniques", Physical Chemistry and Spectroscopy, Los Alamos National Laboratory, Los Alamos, New Mexico, April 13, 2006.
 262. "Atomic Layer Deposition on Particles", *Symposium on "Fundamental Gas-Phase and Surface Chemistry of Vapor-Phase Materials Processing III"*, 209th Meeting of the Electrochemistry Society, Denver, Colorado, May 10, 2006.
 263. "Atomic Layer Deposition of Ceramic Films on Polymers", *Session on Surface Engineering with Ceramics, Surface Processing Science*, International Conferences on Modern Materials and Technologies (CIMTEC 2006), Acireale, Sicily, Italy, June 6, 2006.
 264. "Atomic Layer Deposition of Polymers", AVS Topical Conference on Atomic Layer Deposition (ALD2006), Hotel-Seoul Kyoyuk MunHwa HoeKwan, Seoul, Korea, July 24, 2006.

265. "Molecular Layer Deposition of Organic/Inorganic Hybrid Films", Dept. of Chemistry, Hanyang University, Seoul, Korea, July 27, 2006.
266. "Tantalum Nitride Atomic Layer Deposition Using TBTDET and Hydrogen Radicals, Hydrazine or NH₃", Research and Development Division, Hynix Semiconductor, Inc., Ami-ri Bubal-eub Icheon-si Kyoungki-do, Korea, July 28, 2006.
267. "Atomic Layer Deposition of Polymers", Analytical Chemistry Departmental Seminar, Dept. of Chemistry, University of Colorado, September 18, 2006.
268. "Atomic Layer Deposition of Polymers", Qualcomm MEMS Technologies, San Jose, California, November 15, 2006.
269. "Atomic Layer Deposition of Polymers", Aixtron-Genus, Sunnyvale, California, November 15, 2006.
270. "Atomic Layer Deposition of Polymers", Applied MicroStructures, Inc., San Jose, California, November 16, 2006
271. "Atomic Layer Deposition of Polymers", Lam Research Corporation, Fremont, California, November 16, 2006.
272. "Atomic Layer Deposition on Polymers and Polymer Molecular Layer Deposition", Advanced Materials and Processes Laboratory, Hewlett-Packard Company, Corvallis, Oregon, November 3, 2006.
273. "Atomic Layer Deposition on Nanoparticles", Nanoparticle Science & Engineering Seminar, University of Minnesota, Minneapolis, Minnesota, December 15, 2006.
274. "Atomic Layer Deposition on Polymers & Molecular Layer Deposition of Polymers", ZettaCore Inc., Englewood, Colorado, March 15, 2007.
275. "Atomic Layer Deposition for Thin Film Growth", ASM America Inc., Phoenix, Arizona, March 29, 2007
276. "Atomic Layer Deposition of Copper Barrier and Seed Films", Novellus Fourth International Copper Interconnect Technology Symposium, Tsinghua University, Beijing, China, May 28, 2007.
277. "Atomic Layer Deposition of Copper Barrier and Seed Films", Novellus Fourth International Copper Interconnect Technology Symposium, Fudan University, Shanghai, China, May 30, 2007.
278. "Molecular Layer Deposition of Organic and Hybrid Organic-Inorganic Thin Films", Gordon Research Conference on the *Chemistry of Electronic Materials*, Mount Holyoke College, July 25, 2007.
279. "Molecular Layer Deposition of Alucone and other Organic-Inorganic Polymers", Division

of Inorganic Chemistry, Symposium on *Thin Films: Chemical Vapor Deposition and Atomic Layer Deposition*, American Chemical Society Meeting, Boston, Massachusetts, August 20, 2007.

280. "SiO₂ Atomic Layer Deposition Using Catalyzed Surface Reactions and Silanol Polymerization", Sigma-Aldrich Fine Chemicals, Sheboygan, Wisconsin, September 6, 2007.
281. "Atomic Layer Deposition: Fundamentals and Applications" (Invited Short Course), Sociedad Mexicana de Ciencia y Tecnología de Superficies y Materiales (SMCTSM), XXVII Congreso Nacional, Oaxaca, Oaxaca, Mexico, September 26, 2007.
282. "Atomic Layer Deposition of Nanolaminates: Fabrication and Properties" (Plenary Lecture), Sociedad Mexicana de Ciencia y Tecnología de Superficies y Materiales (SMCTSM), XXVII Congreso Nacional, Oaxaca, Oaxaca, Mexico, September 27, 2007.

RESEARCH GROUP / Steven M. George

As a Ph.D. research advisor, Prof. George has graduated 29 Ph.D. students. Many of these students are now working in industry and government laboratories including four former Ph.D. students at Intel. One of the most recent graduate students to finish, Robert Grubbs, recently received a permanent position at Sandia National Laboratories in Albuquerque. Prof. George has also had numerous undergraduates and postdoctoral research fellows working in his research group. The most recent postdoctoral research fellows to leave the group, Arrelaine Dameron and Rickard Wind, have permanent positions at Dynamic Organic Light and Synkera Technologies, Inc., respectively. Both of these startup companies are in Longmont, Colorado. Another previous postdoctoral research fellow, Ofer Sneh, has started his own startup-company, Sundew Technologies, in Broomfield, Colorado, that is working to commercialize rapid growth ALD reactors. The current group is composed of six graduate students, four postdoctoral research associates and two undergraduate students. Five of the six graduate students are Chemistry Ph.D. students. One graduate student is from Physics.

The current members of the George Research Group are:

| | |
|------------------|---------------------------------|
| Byungyoon Joon | Postdoctoral Research Associate |
| Shaibal Sarkar | Postdoctoral Research Associate |
| Shih-Wui Jen | Postdoctoral Research Associate |
| Xiaohua Du | Postdoctoral Research Associate |
| Beau Burton | Ph.D. Candidate in Chemistry |
| Andrew Cavanagh | Ph.D. Candidate in Physics |
| David Goldstein | Ph.D. Candidate in Chemistry |
| Dragos Seghete | Ph.D. Candidate in Chemistry |
| Aziz Abdulagatov | Ph.D. Candidate in Chemistry |
| Jake Bertrand | Ph.D. Candidate in Chemistry |

The former Ph.D. students and postdoctoral research associates from the George Research Group and their current positions are given below:

| Name | Company or Institution | Job Description |
|-----------------------------------|--------------------------------|------------------------|
| Mark V. Arena (Ph.D., 1991) | Independent Project Analysis | System Analyst |
| David A. Arthur (Ph.D., 1992) | Institute for Defense Analysis | System Analyst |
| Brian S. Berland (Ph.D., 1996) | ITN Energy Systems, Inc. | Staff Scientist |
| John L. Brand (Ph.D., 1989) | Seagate Corporation | Staff Scientist |
| David E. Brown (Ph.D., 1995) | Advanced Micro Devices | Staff Scientist |
| Michelle A. Cameron (Ph.D., 2000) | Rocky Flats Environmental Site | Staff Scientist |
| Peter A. Coon (Ph.D., 1992) | Intel Corporation | Staff Scientist |
| Arrelaine A. Dameron (Postdoc) | Dynamic Organic Light | Staff Scientist |
| Alice A. Deckert (Ph.D., 1989) | Allegheny College | Chemistry Professor |
| Anne C. Dillon (Ph.D., 1993) | National Renewable Energy Lab | Staff Scientist |

| | | |
|-------------------------------------|------------------------------------|----------------------|
| Yijun Du (Postdoc) | Lam Research, Inc. | Staff Scientist |
| Xiaohua Du (Ph.D., 2007) | University of Colorado | Postdoctoral Fellow |
| Jeffrey W. Elam (Postdoc) | Argonne National Lab | Staff Scientist |
| Francois Fabreguette (Postdoc) | Micron, Inc. | Staff Scientist |
| John Ferguson, (Ph.D., 2002) | ALD NanoSolutions | Staff Scientist |
| Krishna L. Foster (Ph.D., 1998) | Calif. State Univ. at Los Angeles | Chemistry Professor |
| Markus Groner (Postdoc) | ALD NanoSolutions | Staff Scientist |
| Robert Grubbs (Ph.D., 2003) | Sandia Natl. Lab/Albuquerque | Staff Scientist |
| P. Kim Gupta (Ph.D., 1991) | Intel Corporation | Staff Scientist |
| David R. Haynes (Ph.D., 1991) | Weyerhaeuser Corporation | Staff Scientist |
| Cari Hermann (Postdoc) | Am. Assoc. Adv. Sci. | Staff Scientist |
| Jason W. Klaus (Ph.D., 1999) | Intel Corporation | Staff Scientist |
| Birgit G. Koehler (Ph.D., 1990) | Bonneville Power Administration | Staff Scientist |
| Aron Krasnopoler (Postdoc) | Washington, D.C. | Consultant |
| Chi Ho Mak (Ph.D., 1988) | Univ. of Southern California | Chemistry Professor |
| Jarod A. McCormick (Ph.D., 2007) | Aixtron-Genus | Staff Scientist |
| D. Laurence Meixner (Ph.D., 1992) | Rockwell Scientific | Executive Director |
| Christine E. Nelson (Ph.D., 2000) | Epson | Staff Scientist |
| Lynne A. Okada (Ph.D., 1997) | Advanced Micro Devices | Staff Scientist |
| Andrew W. Ott (Ph.D., 1997) | Intel Corporation | Staff Scientist |
| Bruce Rayner (Postdoc) | Kurt L. Lesker Company | Staff Scientist |
| MaryBeth Robinson (Ph.D., 1994) | CDM Optics | Patent Agent |
| Noel Rocklein (Postdoc) | Micron, Inc. | Staff Scientist |
| Zachary Sechrist (Ph.D. 2006) | Navy Labs, China Lake | Postdoctoral Fellow |
| Jamison A. Smith, (Ph.D., 2002) | Univ. of Colorado | Postdoctoral Fellow |
| Ofer Sneh (Postdoc) | Sundew Technologies | Founder |
| Nivaldo J. Tro (Ph.D., 1989) | Westmont College | Chemistry Professor |
| Erik D. Westre (Ph.D., 1993) | Seagate Corporation | Staff Scientist |
| Rickard W. Wind (Postdoc) | Synkera Technologies Inc. | Staff Scientist |
| Christopher A. Wilson (Ph.D., 2007) | University of Colorado/Front Range | Chemistry Instructor |
| Michael L. Wise (Ph.D., 1994) | IBM/Siemens Components | Staff Scientist |

Current & Pending Research Support

A. Current Research Support

Source: National Science Foundation

Title: "Molecular Layer Deposition of Polymers: Nucleation, Surface Chemistry and Nanocomposites"

Funding Level: \$180,000

Period: 8/1/07-7/31/08

Research Location: Univ. of Colorado at Boulder

Person-months Per Year Committed to the Project: 1.0 month Summer Salary

Source: Air Force Office of Scientific Research

Title: "Fabrication of Nanolaminates with Ultrathin Nanolayers using Atomic Layer Deposition: Nucleation and Growth Issues"

Funding Level: \$293,093

Period: 1/01/06-11/30/07

Research Location: Univ. of Colorado at Boulder

Person-months Per Year Committed to the Project: 1.0 month summer salary

Source: Department of Energy- Subcontract from University of Minnesota

Title: "Modification of Thermal Emission via Photonic Crystals"

Funding Level: \$47,408

Period: 8/15/06-8/14/07

Research Location: Univ. of Colorado at Boulder

Person-months Per Year Committed to the Project: No salary requested

Source: CU/NREL Energy Initiative

Title: "Solar Cell Based on Interpenetrating Network of II-VI Semiconductor Nanowires in Oriented TiO₂ Nanotube Array"

Funding Level: \$45,000

Period: 07/01/07-6/30/09

Research Location: Univ. of Colorado at Boulder

Person-months Per Year Committed to the Project: No salary requested

Source: Synkera Technologies, Inc - Phase II SBIR

Title: "Atomic Layer Deposition of Reinforcing Nanorods Inside Nanoporous Anodic Alumina Wafers"

Funding Level: \$221,755

Period: 9/15/05-3/14/08

Research Location: Univ. of Colorado at Boulder

Person-months Per Year Committed to the Project: No salary requested

Source: Synkera Technologies, Inc - Phase I SBIR
Title: "Atomic Layer Deposition Chemistry for Indium Nitride, Gallium Nitride, and Ternary Indium Gallium Nitride"
Funding Level: \$48,216
Period: 01/01/07-12/31/07
Research Location: Univ. of Colorado at Boulder
Person-months Per Year Committed to the Project: No salary requested

Source: Department of Defense- DARPA
Title: "Fundamental Research to Enable NEMS/CMOS Integration and All Mechanical Computing Architectures" (Co-PI; PI: Prof. Victor Bright)
Funding Level: \$350,000
Period: 1/1/07-6/30/08
Research Location: Univ. of Colorado at Boulder
Person-months Per Year Committed to the Project: 1.0 month summer salary

Source: Department of Defense- DARPA iMINT Center at CU
Title: "Atomic Layer Deposition Applications for MEMs Sensors" (Co-PI; PI: Prof. Y.C. Lee)
Funding Level: \$100,000
Period: 9/1/06-8/30/07
Research Location: Univ. of Colorado at Boulder
Person-months Per Year Committed to the Project: No salary requested

Source: National Science Foundation - NIRT
Title: "Three-Dimensional Nanomanufacturing Processes for Nanophotonic Devices and Systems"
Funding Level: \$210,938
Period: 8/15/03-7/31/2008
Research Location: Univ. of Colorado at Boulder
Person-months Per Year Committed to the Project: No salary requested

B. Pending Research Support

Source: Department of Energy- Subcontract from University of Minnesota
Title: "Modification of Thermal Emission via Photonic Crystals"
Funding Level: \$47,408
Period: 8/15/07-8/14/08
Research Location: Univ. of Colorado at Boulder
Person-months Per Year Committed to the Project: No salary requested

Source: ALD NanoSolutions Phase I SBIR from NSF
Title: "Flexible Inorganic/Polymer Multilayer Gas Diffusion Barrier Films"
Funding Level: \$45,000
Period: 11/1/07-10/31/08
Research Location: Univ. of Colorado at Boulder
Person-months Per Year Committed to the Project: No salary requested

Source: ALD NanoSolutions Phase I STTR from AFOSR
Title: "Atomic Layer Deposition to Protect Polymers in Space"
Funding Level: \$30,000
Period: 9/15/07-6/14/08
Research Location: Univ. of Colorado at Boulder
Person-months Per Year Committed to the Project: No salary requested

Description of Service

Most of the service of Steven George outside of the University of Colorado is described under "Current and Recent Professional Activities" in his 3-page CV. The highlights of this outside service are his active involvement with the American Vacuum Society (AVS) and the Topical Conference for Atomic Layer Deposition (ALD) sponsored by the AVS. Prof. George was the program chair for the International Symposium of the AVS in November 2005 in Boston. He currently serves as a Trustee of the AVS (2007-2009). Prof. George has also been on the Conference Committee of every AVS Topical Conference on ALD since the first ALD meeting (ALD2001). In addition, he was the chair of the first ALD meeting (ALD2001) in Monterey, California. He also currently serves as a member of the Program Committee and the Organizing Committee of the Thin Film Division of the AVS.

In terms of service at the University of Colorado, Prof. George is involved in a variety of service activities listed below. Some of these current and recent service activities are listed below. These service activities are current unless otherwise noted by previous dates.

1. CU Wizard. Presents talk on "Chemistry of Energy" to elementary school children.
2. Member, Committee for the Nanomaterials Characterization Facility on the CU Boulder campus.
3. Member, Materials Science Advisory Committee on the CU Boulder campus.
4. Member, General Chemistry Coordination Committee, Dept. of Chemistry and Biochemistry.
5. Graduate Admission Committee for Department of Chemistry and Biochemistry. Focus in area of Physical Chemistry and Materials Chemistry.
6. Program Review Committee. Dept. of Chemistry and Biochemistry.
7. Evaluation Committee for Hire in Nanoscience, Dept. of Chemistry and Biochemistry.
8. Executive Committee, Dept. of Chemical and Biological Engineering ((2006-2007 Academic Year).
9. Junior Advisor for Dept. of Chemical and Biological Engineering (2006-2007 Academic Year). Advise approximately 35 Juniors by meeting with all Juniors individually for

approximately 30 minutes each to review their academic schedule and plan for graduation.

10. Physical Chemistry Graduate Advisor (2005-2006 Academic Year).
11. Primary Unit Evaluation Committee for Chemistry (2005-2006 Academic Year). Co-Chair for the promotion of David Jonas from Associate Professor to Full Professor.

In addition to the various service related activities listed above, Prof. George holds a joint appointment and has very interdisciplinary interests. As a result, he serves on the Ph.D. committees of a variety of students. He typically serves on between 8-10 Ph.D. exams per year in Chemistry, Chemical Engineering, Mechanical Engineering and Physics. He also serves on the Ph.D. qualifying exam committee of between 6-8 students in either Chemistry or Chemical Engineering.

Prof. George also teaches the large *Freshmen Chemistry for Engineers* course (CHEN1211) and its associated laboratory (CHEM1221) every fall semester. He has taught this course consistently since the fall of 1992. Although the official numbers are not maintained, he has probably taught more freshmen students Chemistry than any other professor on campus. The *Freshmen Chemistry for Engineering* course usually starts with 400 students. This current fall of 2007, the number of starting students increased to 480. This course requires constant curriculum development to keep the course fresh and vital for the freshmen students. In addition, this course comes with an unofficial responsibility to help to advise the large number of freshmen students.