

Curriculum Vitae

Robert W. Schwartz

PERSONAL DATA

Professor
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EDUCATION

Ph.D., University of Illinois, 1989, Ceramic Engineering
M.S., North Carolina State University, 1981, Chemistry
B.S., North Carolina State University, 1977, Science Education

PROFESSIONAL EXPERIENCE

5/2002 – present
University of Missouri-Rolla, Professor, Ceramic Engineering
8/2000 – 5/2002
Clemson University, Associate Professor, Materials Science & Engineering
8/1997 – 8/2000
Clemson University, Assistant Professor, Ceramic & Materials Engineering
9/1989 – 9/1997
Sandia National Laboratories, Senior Member of the Technical Staff
5/1980 – 8/1984
B.F. Goodrich Corporation, Advanced R&D Engineer

SOCIETY MEMBERSHIPS

American Ceramic Society, ACerS
Materials Research Society, MRS
Institute for Electronic and Electrical Engineering, IEEE
The International Society for Optical Engineering, SPIE
National Institute of Ceramic Engineers, NICE
American Society of Engineering Educators, ASEE
American Association for the Advancement of Science, AAAS

PROFESSIONAL ACTIVITIES

- American Ceramic Society, Interim Secretary Elect, Electronics Division (2003 – Present)
- American Ceramic Society, Chairman, Membership Committee, Electronics Division, (2002 – Present)
- IEEE Ultrasonics, Ferroelectrics, and Frequency Control Division, Chairman, Standards Subcommittee on Piezomagnetism (2003 – Present)
- IEEE, Ultrasonics, Ferroelectrics, and Frequency Control Division, Chairman, Education Committee, (2002 – 2003)
- Keramos National Board of Directors, Treasurer (2002 – Present)
- Keramos National Board of Directors, Secretary (2000 – 2002)
- Associate Editor, Journal of the American Ceramic Society (2003 – Present)
- Associate Editor, Journal of Inorganic Materials (1999 – 2002)
- American Ceramic Society, Symposium Organizer for the 105th Annual Meeting, Nashville, TN, April, 2003 (2002 – 2003)
- American Ceramic Society, Meeting Organizer for Electronics Division Meeting, October 8 – 11, 2000, Clemson University, Clemson, SC (1999-2000)
- American Ceramic Society, Symposium Organizer for the Pacific Coast Regional Meeting, October, 1998, Irvine, CA (1997-1998)
- Materials Research Society, Symposium Organizer for 1998 Ferroelectric Thin Films VII Meeting (1997-1999)
- Materials Research Society, Lead Symposium Organizer for 1999 Ferroelectric Thin Films VIII Meeting (1998-2000)
- Materials Research Society, Symposium Organizer for 2000 Ferroelectric Thin Films IX Meeting (1999-2001)
- Reviewer for J. Mater. Res., J. Am. Ceram. Soc., Appl. Phys. Lett., J. Vac. Sci. Tech., J. Electroceram., J. Inorg. Chem., Mat. Chem. and Phys., Sur. Sci., U.S. Dept. of Energy, NSF, Hong Kong Research Grants Council, Austrian Research Council.

PUBLICATIONS

Books and Monographs

7. R. W. Schwartz, J. Ballato, and G. H. Haertling, “Piezoelectric and Electrooptic Ceramics,” in Ceramic Materials for Electronics: Processing, Properties, and Applications, 3rd Edition, R. C. Buchanan, Ed. (Dekker, New York, 2003). *In press*.
6. P. C. McIntyre, S. Gilbert, Y. Miyasaka, R. W. Schwartz, and D. Wouters, Ferroelectric Thin Films IX, Materials Research Society Symposium Proceedings, Vol. 655 (Materials Research Society, Warrendale, PA, 2001) 590 pp.
5. R. W. Schwartz, P. C. McIntyre, Y. Miyasaka, S. Summerfelt, S. and D. Wouters, Ferroelectric Thin Films VIII, Materials Research Society Symposium Proceedings, Vol. 596 (Materials Research Society, Warrendale, PA, 2000) 575 pp.

4. R. E. Jones, R. W. Schwartz, S. Summerfelt, and I. Yoo, Ferroelectric Thin Films VII, Materials Research Society Symposium Proceedings, Vol. 541, (Materials Research Society, Warrendale, PA, 1999) 770 pp.
3. C. J. Brinker, C. S. Ashley, R. A. Cairncross, K. S. Chen, A. J. Hurd, S. T. Reed, J. Samuel, P. R. Schunk, R. W. Schwartz, and C. S. Scotto, Sol-Gel Derived Ceramic Films: Fundamentals and Applications, in Metallurgical and Ceramic Coatings, (1995), Chapman Hall, London.
2. R. W. Schwartz, Electronic Properties and Material Structure, in Kirk-Olthmer Encyclopedia of Chemical Technology, 4th Ed., **5**, (1993), John Wiley & Sons, Inc., New York, NY, pp. 683-697.
1. R. W. Schwartz, Electronic and Magnetic Ceramics, in Characterization of Ceramics, Loehman, R. E., Ed., (1993), Butterworth-Heinemann, Boston, MA, pp. 229-252.

Refereed Journal Publications

44. R. W. Schwartz, N. Navapan, D. Dinger, D., and L. Mann, "Deflocculation and Mixing Behavior of BaTiO₃ Powders During Aqueous Processing," (2003) *In preparation*.
43. C. Preethy Menon, J. Philip, M. T. Sebastian, and R. W. Schwartz, "Thermal Properties of La_{0.5}Sr_{0.5}Co_{1-x}Ni_xO_{3-δ} Ceramics Using Photopyroelectric Technique," (2003) *In preparation*.
42. P. Yang, D. Carroll, J. Ballato, and R. W. Schwartz, "Growth and Optical Properties of SrBi₂Nb₂O₉ Ferroelectric Thin Films Using Pulsed Laser Deposition," *Appl. Phys. Lett.*, (2002). *Accepted*.
41. P. Yang, D. L. Carroll, J. Ballato, and R. W. Schwartz, "Electrical Properties of SrBi₂Ta₂O₉ Thin Films at Low Temperature," *Appl. Phys. Lett.*, (2002) *Accepted*.
40. R. W. Schwartz and M. Narayanan, "Development of High Performance Stress-Biased Actuators through the Incorporation of Mechanical Pre-Loads, *Sens. & Act.: A Physical*, **101** [3], 322 (2002).
39. P. Yang, J. Xu, J. M. Ballato, R. W. Schwartz, and D. L. Carroll, "Optical Limiting in SrBi₂Ta₂O₉ and PbZr_xTi_{1-x}O₃ Thin Films, *Appl. Phys. Lett.*, **80** [18], 3394 (2002).
38. M. Greene, R. W. Schwartz, and J. W. Treleaven, "Short Residence Time Graphitization of Mesophase Pitch-Based Carbon Fibers," **40** [8] 1217 (2002).

37. R. W. Schwartz, L. E. Cross, and Q.-M. Wang, "Estimation of the Effective Piezoelectric d_{31} Coefficients of Rainbow Ceramics and Comments on Their Enhanced Performance," *J. Am. Ceram. Soc.*, **84** [11], 2563 (2001).
36. J. Ballato, R. Schwartz, and A. Ballato, "Network Formalism for Modeling Functionally Gradient Piezoelectric Plates and Stacks and Simulations of RAINBOW Ceramic Actuators," *IEEE Trans. UFFC* **48**, 462 (2001).
35. J. Ballato, R. Esmacher, R. Schwartz, and M. Dejneka, "Rare-Earth-Doped Ferroelectric PLZT for Active Electro-Optic Devices," *J. Luminescence*, **86**, 101, (2000).
34. R. K. Marcus and R. W. Schwartz, "Compositional Profiling of Solution-Deposited Lead Zirconate Titanate Thin Films by Radio Glow Discharge Atomic Emission Spectroscopy (rf-GD-AES)," *Chem. Phys. Lett.*, **318**, 481 (2000).
33. R. W. Schwartz, P. G. Clem, J. A. Voigt, E. R. Byhoff, M. Van Stry, T. J. Headley, and N. A. Missert, "Control of Microstructure and Orientation in Solution Deposited BaTiO₃ and SrTiO₃ Thin Films," *J. Am. Ceram. Soc.*, **82** (9), 2359 (1999).
32. J. Zhang, B. I. Lee, R. W. Schwartz, and Z. Ding, "Grain Oriented Crystallization, Piezoelectric and Pyroelectric Properties of (Ba_xSr_{2-x})TiSi₂O₈ Glass-Ceramics," *J. Appl. Phys.*, **85** (12), 8343, (1999).
31. C.-F. Xia, T. L. Ward, P. Atanasova, and R. W. Schwartz, "Metal-Organic Chemical Vapor Deposition of Sr-Co-Fe-O Films on Porous Substrates," *J. Mater. Res.*, **13** (1), 173 (1998).
30. T. J. Boyle, D. B. Dimos, R. W. Schwartz, T. M. Alam, M. B. Sinclair, and C. D. Buchheit, "Aging Characteristics of a Hybrid Sol-Gel Pb(Zr,Ti)O₃ Precursor Solution," *J. Mater. Res.*, **12** (4), 1022 (1997).
29. R. W. Schwartz, J. A. Voigt, B. A. Tuttle, R. S. DaSalla, and D. A. Payne, "Comments on the Effects of Solution Precursor Characteristics and Thermal Processing Conditions on the Crystallization Behavior of Sol-Gel Derived PZT Thin Films," *J. Mater. Res.*, **12** (2), 444 (1997).
28. R. W. Schwartz, "Chemical Solution Deposition of Perovskite Thin Films," *Chemistry Of Materials*, **9** (11), 2325 (1997). *Invited*.
27. R. W. Schwartz, T. L. Reichert, P. G. Clem, D. Dimos, and D. Liu, "A Comparison of Diol and Methanol-Based Chemical Solution Deposition Routes for PZT Thin Film Fabrication," *Integrated Ferroelectrics*, **18** (1-4), 275 (1997).

26. H. N. Al-Shareef, D. Dimos, M. V. Raymond, and R. W. Schwartz, "Tunability and Calculation of the Dielectric Constant of Capacitor Structures with Interdigital Electrodes," *J. Electroceram.*, **1** (2), 145 (1997).
25. M. H. Siadati, T. L. Ward, J. Martus, P. Atanasova, C.-F. Xia, and R. W. Schwartz, "Chemical Vapor Deposition of CeO₂-Doped Y₂O₃-Stabilized Zirconia onto Dense and Porous Substrates," *Adv. Mater. – Chem. Vap. Dep.*, **3** (6), 311 (1997).
24. C. Xia, T. L. Ward, P. Atanasova, C. Xu, and R. W. Schwartz, "Fabrication of Ag/Y₂O₃-Stabilized ZrO₂ Composite Films by MOCVD," *J. Electrochem. Soc.*, **145** (1), L4, (1997).
23. B. A. Tuttle and R. W. Schwartz, "Solution Deposition of Ferroelectric Thin Films," *Mater. Res. Bull.*, **21** (6), 49, (1996).
22. J. P. Collins, R. W. Schwartz, R. Sehgal, T. L. Ward, C. J. Brinker, G. P. Hagen, and C. A. Udovich, "Catalytic Dehydrogenation of Propane in Hydrogen Permselective Membrane Reactors," *Indus. Eng. Chem. Res.*, **35**, 4398 (1996).
21. M. J. Lefevre, J. S. Speck, R. W. Schwartz, D. Dimos, and S. J. Lockwood, "Microstructural Development in Sol-Gel Derived PZT Thin Films: The Role of Precursor Stoichiometry and Processing Environment," *J. Mater. Res.*, **11** (8), 2076 (1996).
20. C. Xia, T. L. Ward, and R. W. Schwartz, "Aerosol-Assisted Chemical Vapor Deposition of CeO₂-Doped Y₂O₃-Stabilized ZrO₂ Films on Porous Ceramic Supports for Membrane Applications," *Adv. Mater. – Chemical Vapor Deposition*, **2** (2), 48 (1996).
19. T. J. Boyle, R. W. Schwartz, R. J. Doedens, and J. W. Ziller, "Synthesis and Structure of Novel Group IV Tridentate Alkoxide Complexes and Ceramic Thin Films Derived Therefrom. X-ray Structures of (H₃CC(CH₂-μ₃-O)(CH₂-μ-O)₂)₂Ti₄(OCH(CH₃)₂)₁₀, (H₃CCH₂C(CH₂-μ₃-O)(CH₂-μ-O)₂)₂Ti₄(OCH(CH₃)₂)₁₀, and (H₃CC(CH₂-μ-O)₃)₂Zr₄(μ-OCH(CH₃)₂)₂(OCH(CH₂)₂)₈," *Inorg. Chem.*, **34**, 1110 (1995).
18. D. Dimos, S. J. Lockwood, R. W. Schwartz, and M. S. Rodgers, "Thin-Film Decoupling Capacitors for Multi-Chip Modules," *Trans. Comp., Pack., & Manuf. Tech. A*, **18**, 174 (1995). **Best paper award.**
17. M. B. Sinclair, D. Dimos, B. G. Potter, Jr., and R. W. Schwartz, "Angularly and Spectrally Resolved Light Scattering from Pb(Zr,Ti)O₃ Thin Films," *J. Am. Ceram. Soc.*, **78** (8), 2027 (1995).

16. W. L. Warren, D. Dimos, B. A. Tuttle, G. E. Pike, R. W. Schwartz, P. J. Clews, and D. C. McIntyre, "Polarization Suppression in PZT Thin Films," *J. Appl. Phys.*, **77**, 6695 (1995).
15. R. W. Schwartz, T. J. Boyle, S. J. Lockwood, M. B. Sinclair, D. Dimos, and C. D. Buchheit, "Sol-Gel Processing of PZT Thin Films: A Review of the State-of-the-Art and Process Optimization Strategies," *Integrated Ferroelectrics*, **7**, 259 (1995).
14. D. Dimos, S. J. Lockwood, R. W. Schwartz, and M. S. Rodgers, "Thin-Film Decoupling Capacitors for Multi-Chip Modules," *IEEE Trans. Components, Packaging, Manuf. Tech. A.*, **18** (1), 174 (1995).
13. M. B. Sinclair, D. Dimos, B. G. Potter, Jr., and R. W. Schwartz, "Light Scattering from Sol-Gel Processed Lead Zirconate Titanate Thin Films," *Integrated Ferroelectrics*, **7**, 225 (1995).
12. M. B. Sinclair, B. G. Potter, Jr., D. Dimos, R. W. Schwartz, and C. D. Buchheit, "Light Scattering from Sol-Gel PZT Thin Films: Surface versus Volume Scattering," *Integrated Ferroelectrics*, **11**, 25 (1995).
11. B. G. Potter, Jr., M. B. Sinclair, D. Dimos, B. A. Tuttle, and R. W. Schwartz, "Electrooptical and Optical Evaluation of $\text{Pb}(\text{Zr,Ti})\text{O}_3$ Thin Films Using Waveguide Refractometry," *J. Non-Cryst. Sol.*, **178**, 69 (1994).
10. B. A. Tuttle, J. A. Voigt, T. J. Headley, B. G. Potter, Jr., D. Dimos, R. W. Schwartz, M. T. Dugger, J. Michael, R. D. Nasby, T. J. Garino, and D. C. Goodnow, "Ferroelectric Thin Film Microstructure Development and Related Property Enhancement," *Ferroelectrics*, **151**, 11 (1994).
9. D. Dimos, W. L. Warren, M. B. Sinclair, B. A. Tuttle, and R. W. Schwartz, "Photoinduced Hysteresis Changes and Optical Storage in $(\text{Pb,Lu})(\text{Zr,Ti})\text{O}_3$ Thin Films and Ceramics," *J. Appl. Phys.*, **76** (7), 4305 (1994).
8. T. J. Boyle and R. W. Schwartz, "An Investigation of Group (IV) Alkoxides as Property Controlling Reagents in the Synthesis of Ceramic Materials," *Comments Inorg. Chem.*, **16** (5), 243 (1994); *Invited*.
7. R. W. Schwartz, D. Dimos, S. J. Lockwood, and V. M. Torres, "Preparation and Properties of Sol-Gel Derived PZT Thin Films for Decoupling Capacitor Applications," *Integrated Ferroelectrics*, **4**, 165 (1994).
6. D. Dimos, R. W. Schwartz, and S. J. Lockwood, "Control of Leakage Resistance in $\text{Pb}(\text{Zr,Ti})\text{O}_3$ Thin Films by Donor Doping," *J. Am. Ceram. Soc.*, **77** (11), 3000 (1994).

5. B. A. Tuttle, T. J. Headley, B. C. Bunker, R. W. Schwartz, T. J. Zender, C. L. Hernandez, D. C. Goodnow, R. J. Tissot, and J. Michael, "Microstructural Evolution of Pb(Zr,Ti)O₃ Thin Films Prepared by Hybrid Metallo-organic Decomposition," *J. Mat. Res.*, **7** (7), 1876 (1992).
4. R. A. Assink and R. W. Schwartz, "¹H and ¹³C NMR Investigations of Pb(Zr,Ti)O₃ Thin Film Precursor Solutions," *Chemistry of Materials*, **5** (4), 511 (1993).
3. R. W. Schwartz, B. A. Tuttle, D. H. Doughty, C. E. Land, D. C. Goodnow, C. L. Hernandez, T. J. Zender, and S. L. Martinez, "Preparation and Characterization of Chemically Derived (Pb,La)TiO₃ Thin Films," *IEEE Trans. UFFC*, **38** (6), 677 (1991).
2. R. W. Schwartz, B. C. Bunker, D. B. Dimos, R. A. Assink, B. A. Tuttle, D. R. Tallant, and I. A. Weinstock, "Solution Chemistry Effects in Pb(Zr,Ti)O₃ Thin Film Processing," *Integrated Ferroelectrics*, **2**, 243 (1991).
1. R. W. Schwartz, D. A. Payne, and A. J. Holland, "The Effects of Hydrolysis and Catalysis Conditions on the Surface Area and Decomposition Behavior of Polymeric Sol-Gel Derived PbTiO₃ Powders," in Ceramic Powder Processing Science, Eds. Hausner, H., Messing, G. W., and Hirano, S., (Deutsche Keramische Gesellschaft, 1989) pp. 165-172.

Conference Proceedings (Reviewed)

34. S. Srinivasan, E. Marotta, J. M. Ochterbeck, R. W. Schwartz, and R. S. Miller, "On Microscale Heat Transfer in Thin Film Pyroelectric Sensors," 40th American Institute of Aeronautics and Astronautics Aerospace Sciences Meeting and Exhibit, January 14-17, 2002, Reno, Nevada; *AIAA Paper 2002-0498*, (2002).
33. R. W. Schwartz and Y.-W. Moon, "Domain Configuration and Switching Contributions to the Enhanced Performance of Rainbow Actuators," *SPIE Smart Structures and Materials, Active materials: Behavior and Mechanics*, **4333**, 408 (2001).
32. R. W. Schwartz, M. T. Sebastian, M. Charoenwongsa, and H. Dobberstein, "Development of Transparent LSCO and LSCNO Conductors for Optical Shutter Systems," *Mat. Res. Soc. Symp. Proc.*, **666** (2001).
31. S. Goodwin-Johansson, P. H. Holloway, G. McGuire, L. Buckley, R. Cozzens, R. Schwartz, and G. Exarhos, "Artificial Eyelid for Protection of Optical Sensors," Smart Structures and Materials 2000: Electroactive Polymer Actuators and Devices (EAPAD), *Proc. SPIE*, **3987**, 225 (2000).

30. K. S. Brinkman, R. W. Schwartz, R. K. Marcus, and A. Anfone, "Depth Profiling of Solution-Deposited Lead Zirconate Titanate Thin Films by Radio Frequency Glow Discharge Atomic Emission Spectroscopy (rf-GDAES), *Mat. Res. Soc. Symp. Proc.*, **596**, 399 (2000).
29. R. W. Schwartz, P. Laoratanakul, W. D. Nothwang, J. Ballato, Y. Moon, and A. Jackson, "Understanding Mechanics and Stress Effects in Rainbow and Thunder Actuators," *SPIE Smart Structures and Materials, Active materials: Behavior and Mechanics*, **3992**, 363 (2000).
28. K. S. Brinkman, R. W. Schwartz, and J. Ballato, "UV Radiation Effects on the Sol-Gel Processing of Ferroelectric PZT Thin Films," *Mat. Res. Soc. Symp. Proc.*, **623** 149 (2000).
27. R. W. Schwartz, M. T. Sebastian, and M. V. Raymond, "Evaluation of LSCO Electrodes for Sensor Protection Devices," *Mat. Res. Soc. Symp. Proc.*, **623**, 365 (2000).
26. H. Dobberstein, R. W. Schwartz, P. G. Clem, and D. Carroll, "Sol-Gel Processing of Oxide Buffer Layers," *Mat. Res. Soc. Symp. Proc.*, **619**, 209 (2000).
25. P. G. Clem, B. A. Tuttle, J. A. Ruffner, C. J. Brinker, R. W. Schwartz, M. A. Rodriguez, and W. L. Warren, "Investigation of PZT//LSCO//Pt//Aerogel Thin Film Composites for Uncooled Pyroelectric IR Detectors," *Mat. Res. Soc. Symp. Proc.*, **541**, 661 (1999).
24. J. P. Collins, R. Sehgal, R. W. Schwartz, C. J. Brinker, T. L. Ward, G. P. Hagen, and C. A. Udovich, "Catalytic Dehydrogenation of Propane and Isobutane in Hydrogen Permselective Membrane Reactors," *Proc. 4th Intl. Conf. Inorganic Membranes*, (1996).
23. M. F. Ng, T. L. Reichert, R. W. Schwartz, and J. P. Collins, "Fabrication of SrCo_{0.5}FeO_x Oxygen Separation Membranes on Porous Supports," *Proc. 4th Intl. Conf. Inorganic Membranes*, (1996).
22. W. Wanner-Borchardt, S. Hoffmann, R. Waser, W. Theib, and R. W. Schwartz, "Structural Characterization of (Ba_{1-x},Sr_x)TiO₃ (x = 0-1) Thin Films by Optical Methods, SEM and AFM Studies," *Proc. Electroceramics V; Intl. Conf. On Elec. Ceram. And Appl.*, **1**, 415 (1996).
21. R. W. Schwartz, J. A. Voigt, T. J. Boyle, T. A. Christenson, and C. D. Buchheit, "Control of Thin Film Processing Behavior Through Precursor Structural Modifications," *Ceramic Engineering & Science Proceedings*, **16** (5), 1045 (1995).

20. R. W. Schwartz, R. A. Assink, D. Dimos, M. B. Sinclair, T. J. Boyle, and C. D. Buchheit, "Effects of Acetylacetone Additions on PZT Thin Film Processing," in Ferroelectric Thin Films IV, *Mat. Res. Soc. Symp. Proc.*, **361**, 377 (1995).
19. T. M. Alam, T. J. Boyle, C. D. Buchheit, R. W. Schwartz, and J. W. Ziller, "Formation, Structure, and Material Properties from the Reaction Product of $M(\text{OCHMe}_2)_4$ ($M = \text{Ti, Zr}$) and HOAc," in Better Ceramics Through Chemistry VI, *Mat. Res. Soc. Symp. Proc.*, **346**, 35 (1994).
18. T. J. Boyle, A. T. Pearson, and R. W. Schwartz, "Synthesis and Characterization of Group IV Metal Adamantanol Alkoxides as Potential PZT Precursors," *Ceramic Trans.*, **43**, 79 (1994).
17. R. W. Schwartz, T. J. Boyle, J. A. Voigt, and C. D. Buchheit, "Densification and Crystallization of Zirconia Thin Films Prepared by Sol-Gel Processing," *Ceramic Transactions; Ferroic Materials: Design, Preparation, and Characterization*, **43**, 145 (1994).
16. S. J. Lockwood, R. W. Schwartz, B. A. Tuttle, and V. A. Thomas, "Solution Chemistry Optimization of Sol-Gel Processed PZT Thin Films," in Ferroelectric Thin Films III, *Mat. Res. Soc. Symp. Proc.*, **310**, 275 (1993).
15. C. Chandler, M. J. Hampden-Smith, and R. W. Schwartz, "Ferroelectric Thin Films via Sol-Gel Processing of Single Source Precursors," in Ferroelectric Thin Films III, *Mat. Res. Soc. Symp. Proc.*, **310**, 357 (1993).
14. W. L. Warren, B. A. Tuttle, R. W. Schwartz, W. F. Hammetter, D. C. Goodnow, J. T. Evans, Jr., and J. A. Bullington, "Microstructural Evolution of $\text{Pb}(\text{Zr,Ti})\text{O}_3$ Ceramics Using Electron Paramagnetic Resonance," in Ferroelectric Thin Films III, *Mat. Res. Soc. Symp. Proc.*, **310**, 3 (1993).
13. R. W. Schwartz, D. Dimos, S. J. Lockwood, and V. M. Torres, "Electrical Properties of Sol-Gel PZT Thin Films for Decoupling Capacitor Applications," in Ferroelectric Thin Films III, *Mat. Res. Soc. Symp. Proc.*, **310**, 59 (1993).
12. R. W. Schwartz, R. A. Assink, and T. J. Headley, "Solution Chemistry Effects in PZT Thin Film Processing: Spectroscopic and Microstructural Characterization," in Ferroelectric Thin Films II, *Mat. Res. Soc. Symp. Proc.*, **243**, 245 (1992).
11. D. B. Dimos and R. W. Schwartz, "Electrooptic Properties of PZT Films for Image Storage Applications," in Ferroelectric Thin Films, *Mat. Res. Soc. Symp. Proc.*, **243**, 73 (1992).
10. B. A. Tuttle, J. A. Voigt, T. J. Garino, D. C. Goodnow, R. W. Schwartz, D. L. Lamma, T. J. Headley, and M. O. Eatough, "Chemically Prepared $\text{Pb}(\text{Zr,Ti})\text{O}_3$ Thin Films: The Effects of Orientation and Stress," *IEEE 8th ISAF Proc.*, 344 (1992).

9. R. W. Schwartz, B. A. Tuttle, D. H. Doughty, C. E. Land, D. C. Goodnow, C. L. Hernandez, T. J. Zender, and S. L. Martinez, "Electrical Properties of Chemically Derived (Pb,La)TiO₃ Thin Films," *IEEE 7th ISAF Proc.*, 254 (1991).
8. D. B. Dimos, C. E. Land, and R. W. Schwartz, "Electrooptic Effects and Photosensitivities in PLZT Thin Films," *Ceramic Transactions*, **25**, 323 (1991).
7. B. A. Tuttle, R. W. Schwartz, D. H. Doughty, and J. A. Voigt, "Characterization of Chemically Prepared PZT Thin Films," in Ferroelectric Thin Films, *Mat. Res. Soc. Symp. Proc.*, **200**, 159 (1990).
6. R. W. Schwartz, C. D. E. Lakeman, and D. A. Payne, "The Effects of Hydrolysis Conditions, and Acid and Base Additions, on the Gel-to-Ceramic Conversion in Sol-Gel Derived PbTiO₃," in Better Ceramics Through Chemistry IV, *Mat. Res. Soc. Symp. Proc.*, **180**, 335 (1990).
5. R. W. Schwartz, Z. Xu, D. A. Payne, T. A. DeTemple, and M. A. Bradley, "Preparation and Characterization of Sol-gel Derived PbTiO₃ Thin Layers on GaAs," in Ferroelectric Thin Films, *Mat. Res. Soc. Symp. Proc.*, **200**, 167 (1990).
4. B. A. Tuttle, D. H. Doughty, R. W. Schwartz, T. J. Garino, S. L. Martinez, D. C. Goodnow, C. L. Hernandez, R. G. Tissot, and W. F. Hammetter, "Chemically Prepared PZT Films with Niobium Additions," *Ceramic Trans.*, **15**, 179 (1990).
3. R. W. Schwartz, D. A. Payne, P. M. Eccles, and D. J. Eichorst, "Precipitation and Properties of PZT and PLZT Powders," in Ultrastructure Processing of Advanced Ceramic Materials, (John Wiley & Sons, New York, 1988) pp. 487-498.
2. R. W. Schwartz and D. A. Payne, "Crystallization Behavior of Chemically Prepared and Rapidly Solidified PbTiO₃," in Better Ceramics Through Chemistry III, *Mat. Res. Soc. Symp. Proc.*, **121**, 199 (1988); **Graduate student paper award**.
1. R. W. Schwartz, D. J. Eichorst, and D. A. Payne, "Precipitation of PZT and PLZT Powders Using a Continuous Reactor," in Better Ceramics Through Chemistry II, *Mater. Res. Soc. Symp. Proc.*, **73**, 123 (1986).

Conference Proceedings (Unreviewed)

4. H. Dobberstein and R. W. Schwartz, "Modeling the Nucleation and Growth Behavior of Solution Derived Thin Films," *Proc. 1st Symposium on Advanced Materials for Next Generation – Prelude to Functional-Integrated Materials* AIST Chubu, Nagoya, Japan, May 27, 2002. **Invited**.

3. R. W. Schwartz, P. G. Clem, and D. Dimos, "Preparation of BaTiO₃ and SrTiO₃ Thin Films for Communications Applications," *Proc. 8th US-Japan Seminar on Dielectric and Piezoelectric Ceramics*, Plymouth, MA, October 1997, pp. 92-95. *Invited.*
2. R. W. Schwartz and R. S. DaSalla, "Effects of Solution Precursor Nature on Sol-Gel Derived PZT Thin Film Crystallization Behavior and Properties," *Proc. 7th US-Japan Seminar on Dielectric and Piezoelectric Ceramics*, Tsukuba, Japan, November, 1995, pp. 69-72. *Invited.*
1. R. W. Schwartz and D. A. Payne, "Morphology of As-Precipitated and Dried Powders in the PLZT System," *Proc. 44th Ann. Meet. Electronic Microscopy Soc. Am.*, 1986, pp. 838-839.

Research Reports

8. R. W. Schwartz, "Deposition of Ferroelectric Thin Films on Polymeric Substrates," Final Report for contract NAG1 02094; Funding agency: NASA Langley, March, 2003, 17 pp.
7. R. W. Schwartz, P. Laoratanakul, W. D. Nothwang, and J. Ballato, "Modeling and Characterization of Geometric Effects on the Performance of Rainbow Actuators," Final Report for contract NCC-1-283; Funding agency: NASA_Langley, April, 2000, 27 pp.
6. R. W. Schwartz and A. Jackson, "Characterization of Grain Size and Composition Effects on the Imprint Behavior of Piezoelectric THUNDER Actuators," Final Report for contract 3-30-0907-xxxx-67-8774; Funding agency: Materials Research Society – UMRI, Undergraduate Materials Research Initiative Grant, July, 1999, 21 pp.
5. R. W. Schwartz, J. Ballato, P. Laoratanakul, and W. Nothwang, "Modeling and Characterization of Geometric Effects on the Performance of Rainbow Actuators," Second Interim Report for contract NCC-1-283; Funding agency: NASA_Langley, September, 1999, 19 pp.
4. R. W. Schwartz, P. Laoratanakul, and W. D. Nothwang, "Modeling and Characterization of Geometric Effects on the Performance of Rainbow Actuators," Interim report for contract NCC-1-283; Funding agency: NASA_Langley, April, 1999, 40 pp.
3. R. W. Schwartz, "Development of Rainbow and Thunder Actuators for VCSEL Positioning," Final report for contract 3-30-xxxx-0907-30-8376; Funding agency: Sandia National Laboratories, October, 1998, 18 pp.

2. R. W. Schwartz, J. P. Collins, M. F. Ng., C. J. Brinker, T. L. Ward, R. Sehgal, C. F. Xia, C. A. Udovich, J. Masin, and G. P. Hagen, "Inorganic Membrane Reactor Technology CRADA # 1176: Final Report and Assessment of Membrane Technology," Sandia Report, SAND97-0949, A Report to the DOE Office of Industrial Technologies (1997) 144 pp.
1. R. W. Schwartz and M. Van Stry, "Systematic Errors and Unreliability in Ellipsometry Measurements," Sandia Report, 20 pp.

PRESENTATIONS

60 first author presentations including 28 invited talks. Thirteen presentations by supervised students and co-author of 60 additional presentations (not listed).

R. W. Schwartz and H. Dobberstein, "Modeling Microstructure Evolution in Ceramic Thin Films," American Ceramic Society Annual Meeting, Nashville, TN, April, 2003.

R. W. Schwartz, N. Navapan, and J. A. Wood, "Determination of Local Piezoelectric Coefficients in Thunder Actuators by Moiré Interferometry," American Ceramic Society Annual Meeting, Nashville, TN, April, 2003.

R. W. Schwartz, N. Navapan, and M. Narayanan, "Estimation of the Coupling Coefficients of Standard and Spring-Modified Stress-Biased Actuators," American Ceramic Society Annual Meeting, Nashville, TN, April, 2003.

R. W. Schwartz and C. Zhou, "Fundamental Aspects of Antiferroelectric Ceramics for Dielectric Energy Storage," National Science Foundation Center for Dielectric Studies Meeting, University Park, PA, April, 2003.

R. W. Schwartz, "Processing and Microstructural Evolution in Solution-Derived Electroceramic Thin Films," Iowa State University, Department of Materials Science & Engineering Seminar, March, 2003. *Invited.*

R. W. Schwartz, "Analysis of the Performance of Standard and Spring-Modified Stress-Biased Actuators," American Ceramic Society Electronics Division Meeting, Cocoa Beach, FL, January, 2003.

R. W. Schwartz and M. Narayanan, "The Development of New High Performance Mechanical – Electromechanical Actuators," IFFF 2002, Nara, Japan, May 28 – 31, 2002. *Invited.*

R. W. Schwartz and H. Dobberstein "Modeling the Nucleation and Growth Behavior of Solution Derived Thin Films, 1st Symposium on Advanced Materials for Next Generation, "Prelude to Functional-Integrated Materials," Ceramics Research Institute, AIST, Chubu, Nagoya, Japan, May 27, 2002. *Invited.*

R. W. Schwartz, M. Narayanan, and Navapan, N., "Development of New High Performance Stress-Biased Actuators Through The Inclusion of Mechanical Enhancers," American Ceramic Society Annual Meeting, St. Louis, MO, April, 2002. *Invited.*

R. W. Schwartz, "Stress-Biased Actuators: Domain Effects and the Development of New Devices," University of Illinois Department of Materials Science and Engineering Seminar, December 6, 2001. *Invited.*

R. W. Schwartz and M. Narayanan, "Use of Mechanical Pre-Loads to Enhance the Performance of Stress-Biased Actuators," Materials Research Society Fall Meeting, Boston, MA, November, 2001.

R. W. Schwartz, M. Kunz, M. Sebastian, and M. Charoenwongsa, "Development of LSCNO Transparent Electrodes for IR Sensor Protection," DARPA Workshop, Clearwater Beach, FL, September, 2001.

R. W. Schwartz and M. T. Sebastian, "Development of LSCO and LSCNO Thin Films for Sensor Protection Applications," Materials Research Society Spring Meeting, San Francisco, CA, April, 2001.

W. D. Nothwang, R. W. Schwartz, and J. Ballato, "The Fatigue Characteristics of Stress-Biased Piezoelectric Devices as Predicted by an Equivalent Circuit Model," American Ceramic Society Annual Meeting, Indianapolis, IN, April 2001.

W. D. Nothwang, R. W. Schwartz, and J. Ballato, "Using An Equivalent Circuit Model to Predict And Optimize Stress-Biased Actuator Performance," American Ceramic Society Annual Meeting, Indianapolis, IN, April 2001.

W. D. Nothwang, R. W. Schwartz, and J. Ballato, "The Inclusion of Temperature Effect In An Equivalent Circuit Model To Predict Stress-Biased Actuator Performance," American Ceramic Society Annual Meeting, Indianapolis, IN, April 2001.

R. W. Schwartz, "Stress-Biased Actuators: Approaches to Improve Performance and New Applications," The Payne Symposium, University of Illinois Urbana-Champaign, IL, April, 2001. *Invited.*

R. W. Schwartz, D. Dausch, Y.-W. Moon, M. Narayanan, and W. D. Nothwang, "Intrinsic and Extrinsic Contributions to the Electromechanical Response of Stress-Biased Piezoelectric Actuators," American Ceramic Society Annual Meeting, Indianapolis, IN, April 2001.

R. W. Schwartz, "Rainbow and Thunder Actuators: Fabrication, Performance, and Applications," University of Missouri, Department of Ceramic Engineering Seminar, April, 2001. *Invited.*

R. W. Schwartz, and Y.-W. Moon, "Domain Configuration and Switching Contributions to the Enhanced Performance of Rainbow Actuators," SPIE Smart Structures and Materials Meeting, Newport Beach, CA, March, 2001.

H. D. Dobberstein, S. Johnson, R. W. Schwartz, P. G. Clem, and D. Carroll, "Structural Evolution in Ho_2O_3 Thin Films Deposited on Biaxially Textured Ni," Electronics Division Meeting of the American Ceramic Society, October, 2000, Clemson, SC.

R. W. Schwartz, L. E. Cross, and Q.-M. Wang, "Estimation of the Piezoelectric d_{31} -Coefficients of Stress-Biased Rainbow Actuators," Electronics Division Meeting of the American Ceramic Society, October, 2000, Clemson, SC.

R. W. Schwartz, and Y.-W. Moon, "Analysis of Stress Enhancements to the Performance of Rainbow and Thunder Actuators," Electronics Division Meeting of the American Ceramic Society, October, 2000, Clemson, SC.

K. S. Brinkman, W. D. Nothwang, and R. W. Schwartz, "Understanding the Performance of THUNDER Actuators: The Role of Stress and Device Mechanics," Processing of Fibers and Composites Conference, Chair: K.K. Chawla (Univ of Alabama Birmingham) Castelvechio Pascoli, Italy, May 21-26, 2000.

W. D. Nothwang, R. W. Schwartz, and J. Ballato, "Simple Plate Resonator Modeling and Characterization of the Effects of Mass Loading on the Strain Response of Piezoelectric Actuators," American Ceramic Society Annual Meeting, St. Louis, MO, April 30 – May 3, 2000.

W. D. Nothwang, R. W. Schwartz, and J. Ballato, "The Use of an Equivalent Circuit Model to Describe Aging and Fatigue Effects in Piezoelectric Ceramics," American Ceramic Society Annual Meeting, St. Louis, MO, April 30 – May 3, 2000.

R. W. Schwartz, P. Laoratanakul, W. D. Nothwang, and J. Ballato, "Comments on Geometric Effects on the Performance of Rainbow Ceramics," American Ceramic Society Annual Meeting, St. Louis, MO, April 30 – May 3, 2000.

H. Dobberstein, R. W. Schwartz, and P. G. Clem, and D. Carroll, "Sol-Gel Processing of Oxide Buffer Layers," Materials Research Society Spring Meeting, April, 2000, San Francisco, CA; ***Symposium Best Poster Award***.

K. S. Brinkman, R. W. Schwartz, and J. Ballato, "UV Radiation Effects on the Sol-Gel Processing of Ferroelectric PZT Thin Films," Materials Research Society Spring Meeting, April, 2000, San Francisco, CA.

N. Navapan and R. W. Schwartz, "Chemical and Mixing Effects in the Deflocculation of Aqueous Barium Titanate Suspensions," American Ceramic Society Southeastern Section Meeting, March 29, 2000, Clemson, SC.

R. W. Schwartz, "Chemical Solution Deposition of Ferroelectric Thin Films, 11th International Symposium on Integrated Ferroelectrics, Aachen, Germany, March, 2000. *Invited*.

R. W. Schwartz, P. Laoratanakul, W. D. Nothwang, J. Ballato, Y.-W. Moon, and A. Jackson, "Understanding Mechanics and Stress Effects in Rainbow and Thunder Actuators," SPIE, Smart Materials and Structures Meeting, Newport Beach, March 6 – 9, 2000.

R. W. Schwartz, "Research Activities In Electronic Ceramics at Clemson University, AVX Corporation, Myrtle Beach, SC (June 28, 1999). *Invited*.

R. W. Schwartz, "Electronic Materials and Piezoelectric Ceramics Research at Clemson University," Sandia National Laboratories, Albuquerque, NM (June 21, 1999). *Invited*.

Nothwang, W. D., Schwartz, R. W., Ballato, J., "Equivalent Circuit Modeling of Piezoelectric Rainbow Actuators," American Ceramic Society Annual Meeting, Indianapolis, IN (April, 1999).

P. Laoratanakul and R. W. Schwartz, "Modeling and Characterization of Stress and Geometric Effects on the Performance of Rainbow Ceramics," American Ceramic Society Annual Meeting, Indianapolis, IN (April, 1999).

R. W. Schwartz, "Electroceramic Thin Films: Fundamentals and Applications," American Ceramic Society – Minnesota Section, Ceramic Thin Films Workshop, Minneapolis, MN (March 19, 1999). *Invited*.

R. W. Schwartz, "Understanding Stress Effects on the Performance of Stress-Biased Piezoelectric Actuators," 3M Company, Minneapolis, MN (March 18, 1999). *Invited*.

R. W. Schwartz, H. Dobberstein, A. King, P. G. Clem, and J. A. Voigt, "Solution Deposition Routes for the Fabrication of Perovskite Buffer Layers," Materials Research Society Fall Meeting (November 29 through December 4, 1998).

H. Dobberstein, R. W. Schwartz, and P. G. Clem, "Solution Deposition of Perovskite Buffer Layers Using Trifluoroacetic-based Precursors," American Ceramic Society Southeast Sectional Meeting, Nashville, TN (November 17-18, 1998).

R. W. Schwartz, M. L. Richard, P. Laoratanakul, P. L. Robertson, and K. Gass, "Development of Actuators for VCSEL Positioning and the Role of Stress in Stress-Biased Actuators," American Ceramic Society Southeast Sectional Meeting, Nashville, TN (November 17-18, 1998).

R. W. Schwartz, M. L. Richard, P. Laoratanakul, P. L. Robertson, and K. Gass, "Development of Rainbow Actuators for VCSEL Positioning," American Ceramic Society Pacific Coast Meeting, Irvine, CA (October 21 – 24, 1998).

R. W. Schwartz, H. Dobberstein, A. King, P. G. Clem, and J. A. Voigt, "Control of the Nucleation and Growth Process in Solution-Derived Perovskite Thin Films," 100th Annual Meeting of the American Ceramic Society, Cincinnati, OH, May, 1998.

R. W. Schwartz, "Chemical Solution Deposition of Ferroelectric Thin Films," Georgia Institute of Technology, Department of Materials Science and Engineering Seminar, March, 1998. *Invited.*

R. W. Schwartz, "Chemical Solution Deposition of Ferroelectric Thin Films," University of Illinois, Department of Materials Science and Engineering Seminar, Urbana, IL (February 25, 1998). *Invited.*

R. W. Schwartz, "Chemical Solution Deposition of Perovskite Thin Films for Electronic Applications," Pacific Coast Regional Meeting of the American Ceramic Society, San Francisco, CA (October 12-15, 1997). *Invited.*

R. W. Schwartz, G. Spencer, J. Ballato, and H. J. Rack, "New Products from Metallo-Organic Precursors," presentation to the CAEFF Faculty, Clemson University, Clemson, SC (October 7, 1997).

R. W. Schwartz, J. A. Voigt, P. G. Clem, C. S. Ashley, and M. A. Rodriguez, "Development of Buffer Layer Technology for the Integration of High Temperature Superconductors on Bi-axially Textured Ni Substrates," DOE Office of Energy Efficiency and Renewable Energy Program Review, Washington, D.C., (July, 1997).

R. W. Schwartz, J. A. Voigt, and P. G. Clem, "The Influence of Thermodynamic and Kinetic Factors on the Crystallization Behavior of Perovskite Thin Films," American Ceramic Society Annual Meeting, Cincinnati, OH (April, 1997). *Invited.*

R. W. Schwartz, D. Dimos, T. J. Garino, M. Van Stry, and C. Mueller, "Chemical Solution Deposition of BaTiO₃, SrTiO₃, and (Ba,Sr)TiO₃ Thin Films," American Ceramic Society Electronics Division Meeting, San Antonio, TX (October, 1996). *Invited.*

R. W. Schwartz, "Chemical Solution Deposition of BaTiO₃ and Pb(Zr,Ti)O₃ Thin Films for Electronic Applications," Seminar at Aachen University, Aachen, Germany (October, 1996). *Invited.*

R. W. Schwartz and J. A. Voigt, "Thermodynamic Factors Governing the Crystallization Behavior of Perovskite Thin Films," New Mexico Sectional Meeting of the American Ceramic Society, Albuquerque, NM, (September, 1996).

R. W. Schwartz, J. A. Voigt, T. L. Reichert, and M. Van Stry, "Control of Nucleation Behavior in Sol-Gel Derived PZT Thin Films," Materials Research Society Spring Meeting, San Francisco, CA (April, 1996). *Invited.*

R. W. Schwartz, R. S. DaSalla, T. A. Christenson, J. A. Voigt, and D. L. Lamppa, "The Processing Characteristics of TiO₂ and ZrO₂ Thin Films Prepared from Acetate, Acetylacetone, and Amine Modified Precursors," Materials Research Society Spring Meeting, San Francisco, CA (April, 1996).

R. W. Schwartz, J. A. Voigt, B. A. Tuttle, T. L. Reichert, and M. Van Stry, "The Role of Crystallization Driving Force in Defining Thin Film Microstructure," International Symposium on Integrated Ferroelectrics, Tucson, AZ (March, 1996).

R. W. Schwartz, D. B. Dimos, S. J. Lockwood, and T. J. Boyle, "Sol-Gel Processing of Lead Zirconate Titanate Thin Films for Decoupling Capacitors Applications," Toyota Central Research Laboratories, Nagoya, Japan (November, 1995). *Invited.*

R. W. Schwartz, T. J. Boyle, M. B. Sinclair, D. Dimos, "Effects of Solution Precursor Nature on Sol-Gel Derived PZT Thin Film Crystallization Behavior and Properties," New Mexico Sectional Meeting of the American Ceramic Society, Albuquerque, NM, (September, 1995).

R. W. Schwartz, J. P. Collins, M. F. Ng, T. L. Reichert, "Inorganic Membrane Reactor Technology to Provide Improved Energy Utilization in High Temperature Petrochemical Applications," DOE Office of Industrial Technologies Program Review, Oak Brook, IL (May, 1995).

R. W. Schwartz, "Sol-Gel Processing of Ceramic Thin Films," Department of Materials Science and Engineering Seminar, University of California at Santa Barbara, Santa Barbara, CA (April, 1995). *Invited.*

R. W. Schwartz, T. J. Boyle, T. A. Christenson, R. S. DaSalla, and C. D. Buchheit, "The Effect of Modifying Ligands on Sol-Gel Thin Film Processing," American Chemical Society Meeting, Anaheim, CA (April, 1995). *Invited.*

R. W. Schwartz, R. S., DaSalla, T. A. Christenson, J. A. Voigt, T. J. Boyle, M. B. Sinclair, T. M. Alam, D. Dimos, and C. D. Buchheit, "The Role of Organic Constituents and Water Additions in PZT Thin Film Processing," International Symposium on Integrated Ferroelectrics, Colorado Springs, CO (March, 1995). *Invited.*

R. W. Schwartz, T. J. Boyle, S. J. Lockwood, D. Dimos, M. B. Sinclair, and C. D. Buchheit, "The Development of Improved Solution Deposition Processes for the Fabrication of PZT Thin Films," Materials Research Society Annual Meeting, Boston, MA (December, 1994). *Invited.*

R. W. Schwartz, T. J. Boyle, C. D. Buchheit, R. A. Assink, M. B. Sinclair, D. Dimos, "Effects of 2,4-Pentanedione Additions on the Microstructure and Optical Loss of Sol-Gel Derived PZT Thin Films," Materials Research Society Spring Meeting, San Francisco, CA (April, 1994).

R. W. Schwartz, T. J. Boyle, S. J. Lockwood, M. B. Sinclair, D. Dimos, and C. D. Buchheit, "Optimization of Sol-Gel Processing Conditions for PZT Thin Film Fabrication," International Symposium on Integrated Ferroelectrics, Monterey, CA (March, 1994). *Invited.*

R. W. Schwartz, "Preparation and Properties of Ferroelectric Thin Films," University of Illinois, Department of Materials Science and Engineering Seminar, Champaign-Urbana, IL, (March 19, 1993). *Invited.*

R. W. Schwartz, D. Dimos, B. A. Tuttle, "Dielectric and Ferroelectric Properties of $\text{Pb}(\text{Zr,Ti})\text{O}_3$ Thin Films," American Ceramic Society Annual Meeting, Minneapolis, MN (May, 1992).

R. W. Schwartz, "Fabrication of PZT Ferroelectric Thin Films for Electronic Applications," Department of Chemical and Materials Engineering, University of Minnesota, Minneapolis, MN (November, 1991). *Invited.*

R. W. Schwartz, R. A. Assink, T. J. Headley, and B. A. Tuttle, "Solution Chemistry Effects on the Microstructural Evolution and Ferroelectric Properties of Sol-Gel Derived PZT Thin Films," New Mexico Sectional Meeting of the American Ceramic Society, Albuquerque, NM, (September, 1991).

R. W. Schwartz, "Sol-Gel Processing of Ferroelectric Thin Films," Sol-Gel Technology Transfer Workshop, sponsored by Sandia National Laboratories Albuquerque, NM (August 7-9, 1990). *Invited.*

R. W. Schwartz and D. A. Payne, "The Effects of Hydrolysis and Catalysis Conditions on the Structure and Crystallization Behavior of Sol-Gel Derived Lead Titanate," American Ceramic Society Annual Meeting, Indianapolis, IN (April 23-27, 1989).

R. W. Schwartz, Z. Xu, D. A. Payne, and K. B. Budd, "Sol-Gel Processing of Lead Titanate on Compound Semiconductors," American Ceramic Society Annual Meeting, Cincinnati, OH (May 1-5, 1988).

R. W. Schwartz and D. A. Payne, "Sol-Gel Processing and Crystallization Behavior of PbTiO_3 Gels," Pacific Coast Regional Meeting of the American Ceramic Society, Seattle, WA (October, 1987).

R. W. Schwartz and D. A. Payne, "Precipitation of PLZT Powders," American Ceramic Society Annual Meeting, Chicago, IL (April 27-May 1, 1986).

PATENTS AND PATENT APPLICATIONS

“Uncooled Thin Film Pyroelectric IR Detector with Aerogel Thermal Isolation,” with Ruffner, J. A., Clem, P. G., Tuttle, B. A., Brinker, C. J., Warren, W. L., Raymond, M. V. and Bullington, J. A. U. S. Patent 5,949,071.

“Electroactive Apparatus and Methods,” with M. Narayanan; provisional patent application filed April 24, 2001.

HONORS AND AWARDS

Best Symposium Poster Award, Materials Research Society, Spring Meeting, 2000

Best Poster Award, American Ceramic Society, Electronics Division Meeting, 2000

Sigma Xi (1998)

Best Paper Award - 44th IEEE Electronics and Components Technology

Conference, Washington D.C. (1994)

Graduate Student Award, Materials Research Society (1988)

Keramos (1985)

Allied Chemical Company Award for Outstanding Research and

Scholastic Achievements (1979)

Graduated with High Honors (1977)

Phi Kappa Phi (1976)

Phi Lambda Upsilon (1974)

SPONSORED RESEARCH

Note: Support levels shown are for total grant and amount to Schwartz (in parenthesis). Role in project and period of performance are also indicated.

“GAANN: Fellowship Program in Interdisciplinary Graduate Education in Materials Engineering,” U. S. Department of Education, \$499,644 (\$52,000) Principal Investigator (2000-2004).

“Antiferroelectric Dielectrics for Energy Storage Applications,” National Science Foundation Center for Dielectric Studies (\$25,000) Co-Investigator (2003).

“Capacitive Armor for Protection against Rocket Propelled Grenade Attack,” University of Missouri Research Board \$26,300 (\$26,300) Principal Investigator (2003).

“Deposition of PZT Thin Films on Thin Polymeric Substrates,” NASA-Langley, \$29,480 (\$29,480) Principal Investigator (2002).

“Prediction of Aging and Fatigue Effects on the Performance of Thunder Actuators for Space Systems Applications,” South Carolina Space Grant Consortium and NASA-EPSCoR, \$33,815 (\$28,000) Principal Investigator (2001-2002).

“Materials and Devices for Optical Sources and Protection of Optical Sensors,” University of Florida (through DARPA), \$1,346,500, (\$336,625) Principal Investigator (1999-2002).

“Solution Deposition of Perovskite Buffer Layers for HTS Integration on Ni,” Sandia National Laboratories \$120,000 (\$120,000) Principal Investigator (1998-2001).

“Design, Synthesis, Evaluation, and Modeling of Cost-Effective Catalytic Materials,” South Carolina Commission on Higher Education, \$108,000 (\$30,000) Co-Investigator (2000).

“Electroactive Shutter”, University of Florida (through DARPA), \$210,000, (\$105,000) Principal Investigator (1999-2000).

“Preparation and Properties of Polymer-Piezoelectric Ceramic Composites Prepared by Chaotic Mixing,” Chief Research Officer Fellowship, Clemson University, \$10,000 (\$10,000) Co-Investigator (1999-2000).

“Center for Advanced Engineering Fibers and Films,” National Science Foundation, \$9,900,000, (\$150,000) Co-Investigator (1998-2000).

“Characterization of Grain Size and Composition Effects on the Imprint Behavior of Piezoelectric THUNDER Actuators,” Materials Research Society UMRI, \$1,000 (\$1,000) Principal Investigator (1999).

“Evaluate Fabrication of Transparent PLZT by Hot-Pressing,” Advanced Optics Electronics, Inc., \$2,500 (\$2,500) Principal Investigator (1999).

“Evaluation of Stabilization and Carbonization of Cellulose Fibers for Graphite Production,” Thiokol Propulsions, \$2,100, (\$2,100) Principal Investigator (1999).

“Effect of Heat Treatment Conditions on the Properties of Carbon Fibers,” Amoco Polymers, Inc., \$50,040, (\$50,040) Principal Investigator (1998-1999).

“Modeling and Characterization of Geometric Effects on the Performance of RAINBOW Ceramics,” NASA, \$60,000 (\$49,650) Principal Investigator (1998-1999).

“Development of Rainbow and Thunder Actuators for VCSEL Positioning,” Sandia National Laboratories, \$13,371 (\$13,371) Principal Investigator (1998).

“Solution Derived Ceramic Thin Films: Control of Film Microstructure through Seeded Growth,” Clemson University, University Research Grant Council, (\$2,913) Principal Investigator (1997-1998).

“Inorganic Membrane Reactor Technology to Provide Improved Energy Utilization in High Temperature Petrochemical Applications,” DOE Office of Industrial Technologies, Principal Investigator, \$1,100,000, (\$1,100,000) (1994-1996).

GRADUATE STUDENT ADVISING

Current Students

Ph.D.

Thayer, R., (Ph.D.), “Incorporation of Piezoelectric Non-linearity and Domain Switching Behavior into a Finite Element Model,” (May, 2005).

Narayanan, M., (Ph.D.), “Stress-Engineered Piezoelectric Composites with Improved Sensitivity,” (May, 2005).

Navapan, N., (Ph.D.), “Determination of Intrinsic and Extrinsic Contributions to the Piezoelectric Response of Stress-Biased PLZT Ferroelectrics,” (December, 2003).

M.S.

C. Zhou, “Antiferroelectric Dielectrics for Energy Storage Capacitors,” (May, 2004).

Students Graduated

Ph.D.

H. Dobberstein, “A Thermodynamic and Kinetic Model for Nucleation and Growth in Solution Derived Thin Films,” (December, 2002).

W. D. Nothwang, “Using an Equivalent Circuit Analog to Model the Fatigue and Displacement Behavior of Stress-Biased Thunder Actuators,” (August, 2001).

M. S.

M. Kunz, “The Characterization of n-type Transparent Conducting Oxides for Their Application in the IR Region,” (May, 2003).

M. Narayanan, “Enhancements to the Performance of Stress-Biased Actuators Using An External Pre-Load,” (May, 2002)

M. Charoenwongsa, “Electrical and Optical Properties of LSCO Thin Films Prepared by Sol-Gel Processing for Sensor Protection Applications,” (December, 2000).

K. Brinkman, "The Effects of Peroxide Modifying Ligands in Crystalline Sol-Gel Systems," (August, 2000).

M. Greene, "Effects of Fiber Precursor Structure on the Graphitization Kinetics of Carbon Fibers Prepared from Pitch Precursors," (May, 2000).

N. Navapan, "Deflocculation and Mixing Behavior of Barium Titanate Powders during Aqueous Processing," (M.S., December, 1999).

TEACHING

Courses Taught (Beginning Fall 1997)

CME 226 Thermodynamics of Materials, F01
 CER 284 Electronic Properties of Ceramics, F02
 CME 302 Thermo-Chemical Ceramics, F97, F98, F00
 CER 333 Microelectronic Packaging, W03
 CER 362 Mechanical, Electrical, and Optical Properties Laboratory, F02
 CME 410/610 Analytical Processes, S99
 CME 490/690 Characterization of Ceramics, S98
 CME 800 Graduate Student Seminar, S98, F98
 CME 416/616 Electronic and Magnetic Materials, F99, F01
 CME 825 Electrical and Magnetic Materials, S98, S99, S00
 ENGR 101 Introduction to Engineering, F00, F01
 ENGR 120 Engineering Problem Solving and Design, S01
 ENGR 150 Introduction to Materials, F00
 MATE 826 Phase Equilibria in Material Systems, S02
 ME 493/693 Introduction to Engineering Fiber and Film Systems, S99

UNIVERSITY AND PUBLIC SERVICE

Committees

Department: Chair, Faculty Search Committee (2000-2001)
 Chair, Graduate Standards (1999-)
 Member, Curriculum Committee (2001-2002)
 Member, Promotion, Tenure and Review Committee (2000-2001)
 Member, Undergraduate Standards (1997-1999)
 Member, Undergraduate Curriculum (1997-1999)
 Member, Operations (1997-1999)
 Member, Bishop Lecture (1997-2000)
 Library Representative, (1998-2002)
 Safety Officer (2002-Present)

University: Member, Facility Planning Committee (2002)
 Member, Communications Degree Task Force (2002)
 Member, Ad Hoc Committee on the future of SOMM (2002)
 Parliamentarian, Academic Council (2003)

May 9, 2003