Lynn A. Boatner

Group Leader
Synthesis and Properties of Novel Materials Group
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Bio:

- Corporate Fellow and Battelle Distinguished Inventor
- Director, ORNL Center for Radiation Detection Materials and Systems
- Leader, Synthesis and Properties of Novel Materials Group
- Fellow of the following societies: The American Physical Society, The Materials Research Society, The American Ceramic Society, The American Association for the Advancement of Science, The Mineralogical Society of America, ASM International, and the Institute of Materials, Minerals, and Mining of the United Kingdom.

Area of Research:

The development of new materials and to the solution of a wide range of fundamental and applied problems in solid-state science through the application of modern methods for the synthesis and characterization of ceramics, glasses, and alloys and the growth of single crystals.

Research activities have included investigations of the static and dynamic Jahn-Teller effect; electron paramagnetic resonance studies of rare-earth, iron-group, and actinide ions in crystalline materials; the growth and properties of ferroelectric materials; the development and characterization of advanced nuclear waste forms; the growth of single crystals; and ion-damage and epitaxial-regrowth studies of insulating oxides. Most recently, Dr. Boatner's research efforts have been associated with the development and characterization of "smart" nanocomposite surfaces, the application of resonance techniques to the study of textured ceramics, the application of single crystals of stainless steel to investigations of the physics of solidification and microstructural development in alloys, and the development of new scintillator materials and devices for radiation detection applications.

Awards:

Lynn is the recipient of four IR-100 Awards (1982,1985,1996, 2010); the Frank H. Spedding Award for Excellence in Rare Earth Research; the Jesse W. Beams Prize of the American Physical Society Southeastern Section; the Elegant Work Prize of the Institute of Materials, Minerals, and Mining of the United Kingdom; the Jacquet Lucas Award of the American Society for Metals International; the AACG Crystal Growth Award of the American Association for Crystal Growth; a Federal Laboratory Consortium Award for Excellence in Technology Transfer; and a U.S. Department of Defense Innovative Technology Award (2006).

Projects:

Originated the concept of forming “smart” and “active” ceramic nanocomposite surfaces by using ion implantation and thermal processing to form embedded nanophase precipitates of metal-insulator-transition, ferromagnetic, magnetostrictive, etc. nanophase precipitates in inactive host materials.

Patents:

1. U. S. Patent No. 8.258,483 B1, “High Spatial Resolution Particle Detectors,” Co-inventors Lynn A. Boatner and John T. Mihalczo, Issued September 4, 2012.
2. U. S. Patent No. 8,089,047 B2, “Metal-Organic Scintillator Crystals for X-ray, Gamma Ray, and Neutron Detection,” co-inventors Lynn A. Boatner, James A. Kolopus, John S. Neal, Joanne Oxendine Ramey, and Dariusz J. Wisniewski, issued January 3, 2012.
3. U. S. Patent No. 7,952,075 B2, “Neutron Absorption Detector,” co-inventors Zane William Bell and Lynn Allen Boatner, issued May 31, 2011.
4. U. S. Patent No. 7,666,818 B2, “Combinatorial Synthesis of Ceramic materials,” co-inventors Robert J. Lauf, Claudia A. Walls, and Lynn A. Boatner, issued February 23, 2010.
5. U. S. Patent No. 7,629,588 B1, “Activation Detector,” co-inventors Zane William Bell and Lynn Allen Boatner, issued December 8, 2009.
6. U. S. Patent No. 7,601,965 B1, “Infra-Red Signature Neutron Detector,” co-inventors Zane William Bell and Lynn Allen Boatner, Issued October 13, 200.9
7. U.S. Patent No. 7,135,288, “Combinatorial Synthesis of Ceramic Materials,” co-inventors R. J. Lauf, C. A. Walls, and L. A. Boatner, issued November 14, 2006.
8. U. S. Patent No. 5,885,484, “High Temperature Thermometric Phosphors,” co-inventors S. W. Allison, M. R. Cates, L. A. Boatner, and G. T. Gillies, issued March 23, 1999.
9. U. S. Patent No. 5,885,665, “VO2 Precipitates for Self-Protected Optical Surfaces,” co-inventors L. A. Gea and L. A. Boatner, issued March 23, 1999.
10. U. S. Patent No. 5,812,729, “Very High Numerical Aperture Light Transmitting Device,” co-inventors S. W. Allison, L. A. Boatner, and B. C. Sales, issued September 22, 1998.

11. U. S. Patent No. 5,730,528, “High Temperature Thermometric Phosphors for use in a Temperature Sensor,” co-inventors S. W. Allison, M. R. Cates, G. T. Gillies, and L. A. Boatner, issued March 24, 1998.
12. U. S. Patent No. 5,437,729, “Controlled Removal of Ceramic Surfaces With Combination of Ion Implantation and Ultrasonic Energy”,” co-inventors L. A. Boatner, J. Rankin, P. Thevenard, and L. J. Romana, issued August 1, 1995.
13. U. S. Patent No. 5,298,329, “Alkali-Lead-Iron Phosphate Glass and Associated Method,” co-inventors L. A. Boatner, B. C. Sales, and Sofia C. S. Franco, issued March 29, 1994.
14. U. S. Patent No. 5,188,906, “Substrates Suitable for Deposition of Superconducting Thin Films,” co-inventors Roeland Feenstra and L. A. Boatner, issued February 23, 1993.
15. U. S. Patent No. 5,110,790, “Superconducting Thin Films on Potassium Tantalate Substrates,” co-inventors Roeland Feenstra and L. A. Boatner, issued May 5, 1992.
16. U. S. Patent No. 4,847,219, “Novel Lead-Iron Phosphate Glass,” co-inventors L. A. Boatner and B. C. Sales, issued July 11, 1989.
17. U. S. Patent No. 4,847,008, “Lead-Iron Phosphate Glass as a Containment Medium for the Disposal of High-Level Nuclear Wastes,” co-inventors L. A. Boatner and B. C. Sales, issued July 11, 1989.
18. U. S. Patent No. 4,699,889, “Lead Phosphate Glass Compositions for Optical Components,” co-inventors B. C. Sales and L. A. Boatner, issued October 13, 1987
19. U. S. Patent No. 3,651,426, “Light Sensitive Gunn-Effect Device,” co-inventors L. A. Boatner and K. G. Sewell, issued March 21, 1972
20. U. S. Patent No. 3,742,235, “Bolometric Detector Utilizing Electron Paramagnetic Resonance,” Inventor: L. A. Boatner, issued June 26, 1973.

Specialized Skills:

- Experience in the design and fabrication of systems for the investigation of phenomena at low temperature. Design and fabrication of microwave and millimeter-wave components and systems. Experience in the preparation of high-purity materials. Programming experience using Fortran. Research experience in low-energy nuclear scattering theory and superconductivity.
- Experience in the design, construction, and operation of superconducting magnet systems.
- Designed and constructed magnetic resonance spectrometers for operation at 9, 23, and 35 GHz.

Journal covers, textbook, and other micrograph illustrations:

- Poster, "A New Decorative Steel: Cryo-quenched Fe-Ni-Cr Alloy Single Crystals," 2015.
- *Essentials of Materials Science and Engineering,* (Third Edition,SI) by Donald R. Askeland and Wendelin J. Wright, Cengage Learning, Stamford, CT, 2013.
- *Allied High Tech Products, Inc. Calendar,* Micrograph forJuly, 2015.
- *Allied High Tech Products, Inc. Calendar,* Micrograph forMarch, 2013.

- *Buehler. Ltd. Calendar*, Micrograph for December, 2012.

Recent Publications:

Currently 626 Web of Science publications with 19,936 citations (h = 70), and 20 U.S. Patents. Journal Covers, Textbook, and Other Micrograph Illustrations 52.

1. Ling Cai, Jean Toulouse, Leland Harriger, R. Gregory Downing, and L. A. Boatner, "Origin of the crossover between a freezing and a structural transition at low concentration in the relaxor ferroelectric K1-xLixTaO3," the Physical Review B **91**, 134106 (2015).
2. Yuntao Wu, Lynn A. Boatner, Adam Lindsey, Mariya Zhuravleva, Steven Jones, John D. Auxier II, Howard L. Hall, Charles L. Melcher, "Defect engineering in SrI2:Eu2+ single crystal scintillators", Crystal Growth and Design (accepted for publication).
3. F. A. Selim, Jianfeng Ji, A. M. Colosimo, L. A. Boatner, W. Anwand, A. Wagner, P. S. Stepanov, R. Kraus-Rehberg, and T. E Cowan, "ZnO luminescence and scintillation studied by Photo-/X-ray-exitation and γ-induced positron spectroscopy," Physical Review Applied, (submitted for publication).
4. L. A. Boatner, Joanne O. Ramey, James A. Kolopus, and John S. Neal, "Divalent Europium-doped and Un-doped Calcium Iodide Scintillators: Scintillator Characterization and Single Crystal Growth," Nuclear Instruments and Methods in Physics Research A **786**, 23-31 (2015).
5. H. Z. Xue, H. Y. Xiao, Z. Zhu, V. Shutthanandan, L. L. Snead, Lynn Boatner, W. J. Weber, and Y. Zhang, "Ag out-surface diffusion in crystalline SiC with an effective SiO2 diffusiion barrier," Journal of Nuclear Materials **464**, 294-298 (2015).
6. C. Stock, P. M. Gehring, G. Xu, D. Lamago, D. Reznik, M. Russina, J. Wen, and L. A. Boatner, "Fluctuating defects in the incipient relaxor K1-xLixTaO3 (x = 0.02)", the Physical Review B **90,** 224302 (2014).
7. Weikai Yin, Kirby Smithe, Philip Weiser, Michael Stavola, W. Beall Fowler, Lynn A. Boatner, Stephen J. Pearton, David C. Hays, and Sandro G. Koch, "Hydrogen centers and the conductivity of In2O3 single crystals," the Physical Review B **91**, 075208 (2015).
8. E. Palacios, J. A. Rodríguez-Velamazán, M. Evangelisti, G. McIntyre, G. Lorusso, D. Visser, L. J. de Jongh, and L. A. Boatner, "Magnetic structure and matgnetocalorics of GdPO4," the Physical Review B **90**, 214423 (2014).
9. L. A. Boatner, J. O. Ramey, J. A. Kolopus, J. S. Neal, N. J. Cherepy, S. A. Payne, P. R. Beck, A. Burger, E. Rowe, and P. Bhattacharya, "Advances in the growth of alkaline-earth single crystals for scintillator detectors," Proceedings of the SPIE 9215, Hard X-ray, Gamma-Ray, and Neutron Detector Physics XVI, Edited by Arnold Burger, Larry Franks, Ralph B. james, Michael Fiederle, Proc. of SPIE Vol. **9213**, 92130J-1 (2014).
10. P. R. Beck, N. J. Cherepy, S. A. Payne, E. L. Swanberg. K. E. Nelson, P. A. Thelin, S. E. Fisher, S. Hunter, B. M. Wihl, K. S. Shah, R. Hawrami, A. Burger, L. A. Boatner, M. Momayezi, K. Stevens, M. H. Randles, D. Solodovnikov, "Srontium Iodide Instrument Development for Gamma Spectroscopy and Radioisotope Identification," Proceedings of the SPIE 9215, Hard X-

ray, Gamma-Ray, and Neutron Detector Physics XVI, Edited by Arnold Burger, Larry Franks, Ralph B. James, Michael Fiederle, Proc. of SPIE Vol. **9213**, 92130J- (2014).

11. Jianfeng Ji, L. A. Boatner, and F. A. Selim, “Donor characterization in ZnO by thermally stimulated luminescence,” Applied Physics Letters **105**, 041102 (2014).
12. A. K. Kercher, J. O. Ramey, K. J. Carroll, J. O. Kiggans, N. J. Dudney, R. A. Meisner, L. A. Boatner, and G. M. Veith, “Mixed polyanion glass cathodes: Iron phosphate vanadate glasses,” Journal of the Electrochemical Society **161**, A2210-A2215 (2014).
13. Margareta Wagner, Steffen Seiler, Bernd Meyer, Lynn A. Boatner, Michael Schmid, and Ulrike Diebold, “Reducing the In2O3(111) Surface Results in Ordered Indium Adatoms,” Advanced Materials Interfaces 1400289 (2014).
14. Enamul H. Khan, S. C. Langford, J. T. Dickinson, and L. A. Boatner, “The interaction of 193-nm excimer laser radiation with single-crystal zinc oxide: generation of long-lived highly excited particles with evidence of Zn Rydberg formation,” Journal of Applied Physics **116**, 083711 (2014).
15. John D. Budai, Jiawang Hong, Michael E. Manley, Eliot D. Specht, Chen W. Li, Jonathan Z. Tischler, Douglas L. Abernathy, Ayman H. Said, Bogdan M. Leu, Lynn A. Boatner, Robert J. McQueeney, and Olivier Delaire, “Metallization of vanadium dioxide driven by large phonon entropy,” Nature **515**, 535 (2014). (doi:10.1038/nature13865).
16. J. Matt Farmer, Lynn A. Boatner, Bryan C. Chakoumakos, Mao-Hua Du, Michael J. Lance, Claudia J. Rawn, and Jeff C. Bryan, “Structural and crystal chemical properties of rare-earth titanate pyrochlores,” Journal of Alloys and Compounds **605**, 63-70 (2014).
17. Jean Toulouse, L. Cai, R. K. Pattnaik, and L. A. Boatner, “Multiscale dynamics in relaxor ferroelectrics,” Euro Physics Letters **105**, 17001 (2014).
18. J. Matt Farmer, Lynn A. Boatner, Bryan C. Chakoumakos, Claudia J. Rawn, David Mandrus, Rongying Jin, Jeff C. Bryan, “Polymorphism, phase transitions, and thermal expansion of K3Lu(PO4)2,” Journal of Alloys and Compounds **588**, 182-189 (2014).
19. M. Stavola, F. Bekisli, W. Yin, K. Smithe, W. B. Fowler, and L. A. Boatner, “Contrasting the Experimental Properties of Hydrogen in SnO2, In2O3, and TiO2,” Journal of Applied Physics **115**, 012001 (2014).
20. R. Pereira, C. B. Gozzo, I. Guedes, L. A. Boatner, A. J. Terezo, and M. M. Costa, “Impedance spectroscopy study of SiO2-Li2O:Nd2O3 glasses,” Journal of Alloys and Compounds **597**, 79-84 (2014).