Materials Science & Engineering Seminar Series

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Exceptional Piezoelectric Ceramics Through Microstructure Texturing

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ABSTRACT:
Next generation electromechanical devices have undergone significant performance improvements since the incredible properties of single crystal forms of lead-based perovskites were first reported in the late 90's by Park and Shrout. This paper discusses the development of textured analogues of these materials via the templated grain growth (TGG) process with a focus on new ternary morphotropic phase boundary (MPB) piezoelectric compositions. Highly $[001]_c$ oriented $Pb(In_{1/2}Nb_{1/2})O_3$-$Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$ (PIN-PMN-PT) relaxor ferroelectric ceramics with texture fractions of 98% were textured by templated grain growth using $BaTiO_3$ (BT) platelets. The effects of dopants and template amounts on the densification behavior, texture evolution, microstructure development, and dielectric, piezoelectric and ferroelectric properties will be reported. I'll conclude by reviewing recent efforts at Penn State to commercialize the TGG process for the production of textured ternary ceramics for new-generation electromechanical devices.

BIOGRAPHY:

Dr. Gary L. Messing is Distinguished Professor of Ceramic Science and Engineering, and former Head of the Department of Materials Science and Engineering at Penn State. Messing received his B.S. degree in Ceramic Engineering at Alfred University and a Ph.D. in Materials Science and Engineering at the University of Florida.He has published over 300 papers about processes to improve the optical, piezoelectric and structural applications of ceramics including seeding of phase transformations, sintering of layered ceramics, and templated grain growth to produce textured ceramics.

Professor Messing has received numerous awards including the Richard Brook award of the European Ceramic Society, and the Jeppson and Kingery Awards of the American Ceramic Society. Messing is Fellow and Distinguished Life Member of the American Ceramic Society, Fellow of the Materials Research Society and European Ceramic Society, and Academician of the World Academy of Ceramics. He is currently President of the Advisory Board of the World Academy of Ceramics and Editor in Chief of the *Journal of Materials Research.*

Doherty Hall 2210, 11:30AM
Friday, April 27, 2018