
Einladung zum
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Polarizable Deformable Solids

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Structure-property relationships are a basic tenet of materials science and solid-state physics. The talk focuses on the effect of applied electric fields on polarization and deformation phenomena in a special class of insulators, ferroelectric materials. Ferroelectrics are crystalline materials where the symmetry belongs to a polar point group; and by definition, the spontaneous polarization (that originates from local ionic displacements) can be co-operatively reversed by an applied electric field. Switchable polarization gives rise to dielectric hysteresis, and the possibility of various practical applications. In addition, ferroelectrics are piezoelectric (and electrostrictive), and the field-induced mechanical distortions are of interest for electromechanical devices e.g., actuators and positioners.

Recently, we have grown single crystals of ferroelectric $\text{SrBi}_2\text{Ta}_2\text{O}_9$ (SBT) and $\text{Pb}_3\text{MgNb}_2\text{O}_9$ - PbTiO_3 (PMN-PT). Data are reported for the ferroelectric and piezoelectric properties. The suitability for non-volatile ferroelectric memory elements and electromechanical transducers are discussed.

In addition, the role of internal boundary conditions on the dielectric properties of polycrystalline ferroelectrics is discussed. A new method of Curie-Weiss analysis is demonstrated to probe the impedance boundaries in commercial electroceramics, nano-structured materials and thin films. Effects of size and scale are considered.

Curriculum Vitae: Professor D. A. Payne

David A. Payne is Professor of Materials Science and Engineering, and Research Professor in the Frederick Seitz Materials Research Laboratory, at the University of Illinois at Urbana-Champaign. His research activity is in electrical ceramics, particularly for structure-property relations in ferroelectrics and related materials, e.g., capacitor dielectrics and piezoelectrics. He joined the University of Illinois in 1974 and has graduated 49 Ph.D. and M.S. students, and published 259 scientific papers. Honors and Awards, include: Fellow, British Institute of Ceramics; Fellow, American Ceramic Society; Fellow, Institute of Materials; Fellow, International Academy of Ceramics; Fulrath Award, and the Henry Best Paper Award, American Ceramic Society; International Prize, Japan Fine Ceramics Association; and, Distinguished Lecturer, IEEE-UFFC-S for 2001-3.

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