MAE Seminar Series

Flexoelectric Effects in Condensed Matter Systems and their Applications

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Abstract

Flexoelectric effects are defined as the linear coupling relationship between the applied inhomogeneous strain field and the induced electric polarization (direct effect) or the applied inhomogeneous electric field and the induced strain field (converse effect) in condensed matter systems. Although flexoelectric effects are similar to piezoelectric effects, the fundamental physical mechanisms behind them are different. Flexoelectric effects exist in all dielectric materials, whereas piezoelectric effects only exist in the materials with non-central symmetry crystal structures. Usually, flexoelectric effects are too small to be clearly observed in bulk materials. However, it has been proved that, at the mesoscopic scale, those effects not only can be easily detected but also are believed to have significant influences on material properties. For example, flexoelectric effects may play an important role in the origin of the so-called "dielectric dead layer" in nanoscale capacitors. In this seminar, the current theoretical and experimental studies on flexoelectric effects will be summarized. The related research topic, flexoelectric effects in bio-materials, in my group will also be introduced.

Bio

Dr. Fu is assistant professor. He joined MAE Department of the University at Buffalo in August 2008. Between 2005 and 2008, he worked as a postdoctoral scholar in a navy sponsored materials research laboratory. He completed his college education in China, and received his Ph.D. degree in electrical engineering from the Pennsylvania State University at University Park in December 2004. He holds two patents (the second one is a pending patent). He and Dr. L. E. Cross derived a phenomenological theory which demonstrates that there are two types of flexoelectric effects in solid dielectrics in 2007. His current research interests focus on multifunctional materials and devices, material physics, and flexoelectric effects in biomaterials and liquids.

110 Knox Hall
Thursday, February 19th, 2009
3:30 pm – 4:30 pm

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