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Talk Title: "Self-Organized Bottom Up Magnetoelectric Composites"

April 19<sup>th</sup>, 2010, 4:00 to 5:00 PM  
Refreshments served at 3:30  
Wilsdorf Hall, Room 101

**ABSTRACT:**

Magnetoelectric composites have lately received much attention. They are predominantly pre-*pre*-pared by "top down" film deposition or macroscopic methods. In thin films epitaxy leads to 3D self-organization at the expense of stresses that can detrimentally affect the magnetoelectric characteristics. In this talk we will report on "bottom up" methods to synthesize self-organized magnetoelectrics.

After a general introduction the talk will first recall spinodally synthesized PZT/NFO composites. Here, we created a magnetoelectric 3-1 composite with a coupling coefficient of  $MEH=2.3$  V/A. Next, a diblock copolymer based synthesis of a microstructure consisting of hexagonally arranged ferromagnetic CFO nano-cylinders embedded in a PZT matrix will be discussed. The application of an electric field changes the initial magnetic permeability of the composite by 500% equivalent to  $MEH=10$  V/A. This coupling can be understood in terms of the composites' geometric configuration and its stress free state. An onion-like copolymer based nanostructure was created by room temperature magnetic field annealing of a PS (CFO)-*b*-PEO(PZT) magnetoelectrically doped diblock copolymer. The evolution of this nanostructure has been characterized by AFM, MFM, and TEM. The recorded images suggest that the Lorentz force acting on charges in the paraelectric precursor induce a circular component of the diffusion flux that leads to the onion formation. The structure is superparamagnetic in the gel and magnetoelectric in the crystallized state.

Finally, we will present and discuss the n-structure of a novel self-organized CFO/BTO bulk composite and its ferroelectric and magnetoelectric characteristics. The structure consists of coherent alternating CFO and BTO nano-plates. The CFO plates are dipolar coupled leading to an antiferromagnetic ground state and hence zero remanence. Since the magnetic anisotropy energy is extremely low the initial magnetic and magnetoelectric susceptibilities are very high.

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Technische Universität Dipl. Ing. (Physics) 1956  
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