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NEBRASKA CENTER FOR MATERIALS AND NANOSCIENCE SEMINAR SERIES PRESENTS

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DYNAMIC ASPECTS OF PHASE TRANSITION AND POLARIZATION SWITCHING IN FERROELECTRIC POLYMERS ASSOCIATED WITH THEIR HIERARCHICAL STRUCTURES

An overview is presented with respect to the ferroelectric properties of vinylidene fluoride / trifluoroethylene copolymers over the entire range of composition. Their ferroelectricity originates from the molecular dipoles attached perpendicular to the chain axes. The all-trans conformation of chain molecules and their parallel packing induce an alignment of all molecular dipoles in one direction to produce a large spontaneous polarization. Thin films prepared by spin-coating consist of large crystalline grains in that chain axes are aligned parallel to the film surface. Chain dynamics in such hierarchical structures govern their phase transition and polarization switching phenomena. Successive transitions from ferroelectric to molten phase via antiferroelectric and paraelectric phases are shown to be driven by packing and conformational entropies for copolymers containing 30-50mol% VDF. As the VDF content becomes larger than 50mol%, the antiferroelectric phase disappears. The copolymers containing more than 80mol% directly melt from the ferroelectric phase. Polarization reversal is achieved by rotation of chain molecules about their axes. The switching time shows an exponential dependence on applied electric field below 300MV/m. At higher fields, we observed departure from an exponential law. The fastest switching was 2ns at 800MV/m for a 50nm thick 75/25mol% copolymer film. The nanoscopic switching dynamics revealed by time-resolved PFM will be presented .

Friday, March 26, 2010
201 Brace Lab
2:30 p.m.

Host:
Prof. Steve Ducharme
Physics & Astronomy

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