~~~~ Polymer Physics Seminar ~~~~

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301 Steidle Bldg.

Crosslinked-PVDF-CTFE for Dielectric Energy Storage

Dielectric materials with large electric energy density are actively pursued for many applications. Among commercially available polymer capacitor film, poly(vinylidene fluoride-co-chlorotrifluoroethylene) P(VDF-CTFE) stands out because it exhibited the so-called relaxor-like ferroelectricity behavior. In this talk, we will present our crosslinking approach for improving energy density while reduce dielectric loss of the polymer. The fundamental idea of this effort is to introduce covalently bonding between the polymer chains. This crosslink site will assist enhancement the reversible transformation and reduce ferroelectric domain size. Therefore this technique has emerged as a promising route to decrease dielectric loss while enhance permittivity. By carefully controlling of process conditions and varying the polymer/agents ratios the polymer structures were systematically tuned for optimized properties. The crosslinking method indeed leads to the polymer film with a much lower dielectric loss. For example at the optimum combination of initiator and co-agent, the ferroelectric loss is ~4 % at 200 MV/m, which represents an impressive ~70 % decrease compared to the pristine. As a result, the discharged energy densities are greatly improved to ~18 J/cm^3 @ only 400 MV/m. The mechanisms of dielectric loss were also investigated by various methods. The effect of crosslinking and resulted polymer structures on the dielectric properties and energy densities will be presented.