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## Effects of Plant Protein Based Modifiers on Structures and Ferroelectric Properties of Dielectric Films

Zhuoyuan Zheng

Faculty: Bin Li, PhD

*Department of Mechanical Engineering, College of Engineering*

Plant proteins, as renewable and cost-effective natural resources, have gain increasing interests in non-food applications. In particular, with increasing environmental concerns of petro-polymers, biomass as substitution of traditional petro-polymers has become an important research area. In this study, soy protein isolate (SPI) has been studied as a functional modifier to tune ferroelectric behaviors of polymer dielectric films for advanced capacitor applications with desirable energy density and efficiency. To achieve this goal, SPI based modifiers were prepared via controlled denaturation and modification procedures. The modifiers were then applied to poly (vinylidene fluoride), a ferroelectric polymer. The ferroelectric analysis showed that the energy density and energy efficiency of resulting dielectric films can be effectively tuned by SPI based modifiers to satisfy different capacitor applications. To understand the mechanisms of these tunable properties, SEM, optical microscope, XRD and FTIR were utilized to characterize phase structures and crystal structures of the films.