

Study of Soy Protein as a Dielectric Modifier for Polymer Materials

Wenqing Wang,* Paige Feikert

Faculty: Bin Li

Department of Mechanical Engineering, College of Engineering

Plant proteins, such as soy protein—one of the least expensive and most widely available natural resources—have been widely studied as functional materials. Proteins have great potential in dielectric applications, due to their diverse and multilevel polar structures. This study investigated soy protein as a dielectric modifier to tune the dielectric relaxation behaviors of polyethylene oxide (PEO). The effects of concentration of soy protein, processing, and testing temperature on the dielectric relaxation of PEO behaviors were studied.

High protein content product, soy protein isolate (SPI), was used as the protein source to modify PEO. SPI/PEO composites were fabricated with deionized water and dimethyl sulfoxide (DMSO) as the solvent, respectively, followed by compression molding for dielectric analysis. The results showed that dielectric properties showed strong dependence on the concentration of SPI, with 1wt% SPI leading to highest dielectric constant. Solvent played a critical role as well, with PEO/SPI-H₂O composites showing higher dielectric constant and stronger temperature dependence. Moreover, the addition of SPI, regardless of solvents and SPI concentrations, led to suppressed conduction relaxation mechanism, while having weaker effects on alpha-relaxation of PEO. The knowledge on the roles of SPI as a dielectric modifier will certainly favor exploration of new functionalities of polymer/protein blends and extend the applications of protein & polymer-based functional materials.