MATERIALS ENGINEERING

SEMINAR

"The Use of Temporally Programmed Biaxial Deformation Profiles to Affect Morphological and Dielectric Properties of Polyethylene Terephthalate Films"

By

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ABSTRACT

Discovering novel dielectric materials has been a long-time ambition in material science and is becoming increasingly important, especially for advanced military and energy storage applications. With the development of the technology, scientists are focusing on materials with not only high breakdown strength and high dielectric constant, but other extraordinary properties such as scalability, light weight, and tunability. Polymer materials, especially polymer thin films, have higher breakdown strength and better stability as compared with their traditional ceramic counterparts. More than that, with their advantageous behavior in being stretchable and shapable in intricate geometries, polymer dielectric materials have become popular in the recent years. Numerous studies have been carried out to reveal the relationship between the morphological structures and the dielectric properties of semicrystalline polymers. Polyethylene terephthalate (PET), with its excellent dielectric properties, ideal transparency when crystallized, and processing-enhanced behavior, has been studied for decades. However, there is not much work published about how the dielectric properties change with the varying of morphological structures of the PET.

In this study, we use temporally varying deformation profiles to optimally affect morphological evolution (crystallinity, orientation, crystal size) and resulting dielectric properties of Polyethylene terephthalate films from amorphous precursors for capacitor applications. This will be accomplished with custom build programmable biaxial stretcher that can apply desired programmed deformation profiles to films from amorphous unoriented precursors while measuring true stress, true strain and optical birefringeces real time to investigate stress optical and strain optical behavior to very large deformation levels typically used in industrial manufacturing processes. The structure and dielectric properties (dielectric constant, loss, breakdown) as well as structural parameters of films including crystallinity, orientation, crystal size will be characterized off line to assess deeper understanding of their relationships.

Date: Tuesday; January 11, 2022
Time: 9:00 AM
Place: https://purdue.webex.com/meet/cakmak

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