



Symposia Summary

Bridging Microstructure, Properties, and Processing of Polymer Based Advanced Materials

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Drawing researchers from Europe, the United States, and Asia, this symposium offered 20 presentations in the field of polymer-based advanced materials, ranging from microstructure characterization and property measurement, to processing optimization. Application discussed covered biomaterials, energy materials, nuclear materials, structural materials, and explosives. All of them focused on a common challenge: how to benefit from the fast evolving modeling tools to guide materials design in polymer materials. Researchers approached this challenge from different perspectives to bridge microstructure, properties, and processing.

For instance, on materials design to optimize processing, Dongsheng Li utilized different models to predict mechanical properties of cellulose nanowhisker composite. Performance improvement was demonstrated using materials design, adjusting nanowhisker alignment distribution by magnetic field. Ryan Roeder, University of Notre Dame, presented a novel powder processing and compression molding method to fabricate hydroxyapatite-reinforced polyaryletherketone, using a new multiscale micromechanical model to tailor mechanical properties. Due to the inherent complexity of polymer based advanced materials, modeling part is challenging. Said Ahzi likewise presented his work on a new continuum length scale model for large viscoplastic deformation based on intermediate approach. On the smaller length scale, Douglas Spearot, University of Arkansas, modeled diffusion of the atmospheric penetrates in polydimethylsiloxane-based nanocomposites using molecular dynamics. In his presentation, he discussed how diffusion-related material properties were extracted for the calculation of diffusion constants and activation energies using an Arrhenius style equation. Sharing these and other examples of novel development on modeling and methods advanced the research approach of all who participated.

—Submitted by Dongsheng Li