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Department of Mechanical Engineering
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"Mechanical Behavior of Polymer Nanocomposites"

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Abstract

Various nanoinclusions have been proposed as a means to develop multifunctional nanocomposite materials with outstanding mechanical, electrical, and thermal properties. An enhanced understanding of the nanoscale interaction mechanisms in these systems and their impact on effective properties is required for accurate modeling, and ultimate optimization, of these materials. Of particular interest is the change in effective viscoelastic behavior of the nanocomposite, which are indicative of intimate nanotube-polymer interactions in these material systems, and suggest the potential utility of viscoelastic testing as a means to ascertain nanoscale interactions based on macroscale experimental data. For example, based on such macroscale viscoelastic testing, we have identified and characterized a reduced mobility, non-bulk viscoelastic interphase in NRPs, which is consistent with nanoscale experimental work that has recently confirmed the presence of this interphase region. In order to characterize the impact of this non-bulk interphase region on the global effective properties of the nanocomposite, we have recently developed a methodology to extend a popular micromechanical approach based on the Mori-Tanaka method to analytically describe the dilute strain concentration tensor of randomly-orientation coated inclusions. Such a model will be particularly useful as a means to quantify the impact of nanotube functionalization and the tailorability of this interphase region on polymer nanocomposite properties.

About the speaker

Dr. Frank Fisher has been an Assistant Professor in the Department of Mechanical Engineering at Stevens Institute of Technology in Hoboken, NJ since August 2004. Dr. Fisher earned BS degrees in Mechanical Engineering and Applied Mathematics from the University of Pittsburgh, Masters degrees in Mechanical Engineering and Learning Sciences (School of Education and Social Policy) from Northwestern University, and a Ph.D. in Mechanical Engineering from Northwestern University in 2002.