MECHANICAL & INDUSTRIAL COLLOQUIUM

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MEC 224

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Nanoparticle-Enhanced Crystallization of Semicrystalline Polymer Nanocomposites

ABSTRACT

The introduction of nanoparticles into semicrystalline polymers can influence the development and influence of crystallization present within a semicrystalline polymer nanocomposite. For example, nanoparticles may act as heterogeneous nucleation sites, leading to an increase in nucleation rate, a decrease in crystallite sizes, changes in crystalline structure, and a change in the overall degree of crystallinity. Such differences are often observed and reported under quiescent loading conditions; however, we have found that such changes in crystallization behavior can be drastically accelerated and more pronounced if the crystallization occurs under an external applied loading. Such findings require further study as realistic industry-processed nanocomposites are typically manufactured via techniques that subject the polymer nanocomposite to a complex thermomechanical history. Working with high performance semicrystalline polymers (including PBT, PVDF, PEEK, and nylon), the crystallization of these nanocomposite systems under applied thermomechanical conditions has been studied using both shear and pressure loadings. Our results indicate how nanoparticles, even at very small loadings, can significantly alter the processing-induced crystallization of semicrystalline polymer nanocomposites, and suggest pathways for leveraging this crystallization behavior for improving the performance of semicrystalline polymer nanocomposites.

Biography

Professor Frank Fisher is an Associate Professor in the Department of Mechanical Engineering and co-Director of the Nanotechnology Graduate Program (www.stevens.edu/nano) at Stevens Institute of Technology (Hoboken, NJ). Dr. Fisher earned BS degrees in Mechanical Engineering and Applied Mathematics from the University of Pittsburgh in 1995, Masters degrees in Mechanical Engineering and Learning Sciences (School of Education and Social Policy) from Northwestern University in 1998 and 2000, respectively, and a Ph.D. in Mechanical Engineering from Northwestern University in December 2002. He has been awarded the National Science Foundation's CAREER award, the American Society of Engineering Education (ASEE) Mechanics Division Ferdinand P. Beer and E. Russell Johnson Jr. Outstanding New Educator Award, the 2009 Outstanding Teacher Award from the Stevens Alumni Association, and the 2006 Harvey N. Davis Distinguished Teaching Assistant Professor Award from Stevens.