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Nanotechnology Graduate Program

Network Formation in Carbon Nanotube Composites: Understanding the Impact of a Thermosetting Matrix

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Over the past 20 years, an enormous level of research from academic, government, and industrial organizations has been directed at understanding and developing polymer nanocomposites. Some of this research has shown dramatic property changes, leading to a wide variety of proposed applications and a projected global market value of $9 billion for polymer nanocomposites in 2025. In particular, polymer nanocomposites containing carbon nanotubes (CNTs) have been widely researched in order to produce materials with multifunctional performance. These properties result from a combination of inherent nanoparticle properties and modifications to bulk polymer structure caused by the introduction of nanoparticle surfaces. The latter factor motivates fundamental studies of nanocomposite morphology, in particular network structures that can be leveraged for tailored nanocomposite design. In this research, network behavior in a CNT nanocomposite with a thermosetting matrix was examined to understand how the curing process affects network formation and contrast this behavior with previous results for thermoplastic matrices. Specifically, networks in multiwalled carbon nanotube (MWNT)/PETI-330 composites were studied using processing data, rheological studies, electrical properties, and thermomechanical properties to identify percolation thresholds based on different transport mechanisms, enabling an increased understanding of CNT networks before and after curing and the role that matrix molecular size plays in network formation.

Prof. Meisha L. Shofner is an Assistant Professor in the School of Materials Science and Engineering at Georgia Institute of Technology. She received her B.S. in Mechanical Engineering from The University of Texas at Austin in 1997 and her Ph.D. in Materials Science and Engineering from Rice University in 2004. Prior to joining the faculty at Georgia Tech in 2005, she conducted post-doctoral research at Rensselaer Polytechnic Institute in the Department of Materials Science and Engineering. Dr. Shofner's polymer nanocomposite research at Georgia Tech has been recognized with the Solvay Advanced Polymers Young Faculty Award in 2006 and the Ralph E. Powe Junior Faculty Enhancement Award from Oak Ridge Associated Universities in 2007. She is a registered Professional Engineer in Georgia.

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