

## **CHARACTERIZATION OF NANOCOMPOSITE FILLER MORPHOLOGY USING ULTRA SMALL-ANGLE X-RAY SCATTERING**

Ryan S. Justice<sup>1,2</sup> and Dale W. Schaefer<sup>2</sup>

<sup>1</sup>Air Force Research Laboratory, Materials and Manufacturing Directorate, WPAFB, OH 45433-7750, <sup>2</sup>University of Cincinnati, Department of Chemical and Materials Engineering, Cincinnati, OH 45221-0012

Loading polymer matrices with nanoscale fillers is widely believed to have the potential to push polymer properties to extreme values. Realization of anticipated properties, however, has proven elusive. Recent nanocomposite research suggests better characterization of the large-scale morphology will provide insight explaining these shortfalls. This work will present ultra-small angle X-ray scattering as a viable tool for elucidating the hierarchical filler morphology that exists within polymer nanocomposites. Scattering analysis tools developed by our group will be applied to scattering data from nanocomposites filled with carbon nanotubes, layered silicates, and colloidal silica. The relationship between imaging data and scattering data will be discussed in the context of filler dispersion. Finally, the impact of large-scale filler morphology on mechanical and electrical properties will be discussed.