W0474

Simplified Models for Hierarchical Structures Based on Disks Rods, and Tubes. Ryan S. Justice,[a,b] Jan Ilavsky,[c] Dale W. Schaefer,[b] [a]Air Force Research Laboratory, WPAFB, OH USA, [b]Univ. of Cincinnati, Dept. of Chemical and Materials Engineering, Cincinnati, OH USA, [c]Argonne National Laboratory, Argonne, IL USA.

With rising interest in utilization of polymer nanocomposites for structural applications, quantifying filler dispersion has emerged as a major challenge. To characterize nanocomposite systems with nanosilicates and carbon nanotubes, we have developed models for fractal disks, fractal rigid-rods, and simplified tubes to analyze scattering data. The fractal disk model, for example, incorporates the idea of semi-flexible disk-like entities, allowing the persistence length of the crumpled sheets to be quantified. Simplified rod and tube models capture the essential features of exact models but allow for easy incorporation of large-scale flexibility (worm-like rods and tubes). The mathematical simplicity of the models permits rapid extraction of size distributions when analyzing polydisperse systems.

The models are used to analyze ultra small-angle x-ray data on both water suspensions and composites formed with carbon and silicate colloids. Conclusions from small-angle scattering often conflict with those from electron imaging. Possible reasons why hierarchical morphologies have escaped detection by imaging methods will be discussed.