Deducing Shape of Anisotropic Particles in Solution from Light Scattering: Spindles and Nanorods

Ilona Tsuper  
*Cleveland State University*

Dan Terrano  
*Cleveland State University*

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**Deducing Shape of Anisotropic Particles in Solution from Light Scattering: Spindles and Nanorods**

College of Sciences and Health Professions

**Student Researchers:** Ilona Tsuper and Dan Terrano

**Faculty Advisor:** Kiril A Streletzky

**Abstract**

Depolarized Dynamic light scattering (DDLS) enables to measure \textit{in situ} rotational and translational diffusion of nanoparticles suspended in solution. Their size, shape, diffusion, and intermolecular interactions can be inferred from DDLS data using various models of diffusion. Incorporating DDLS to analyze the dimensions of easily imaged elongated particles, such as Iron (III) oxyhydroxide Spindles (FeOOH) and gold coated Nanorods, will allow a deeper understanding between rotational/translational diffusion and size distribution of hard-to-image anisotropic wet systems such as micelles, microgels, and protein complexes. The emphasis of this study was to look at the aged FeOOH Spindle sample, and explore the size distribution and modeling of the Nanorod particles. The light scattering results obtained from the basic model of non-interacting prolate ellipsoids offered dimensions similar (within 15\%) to the size distribution from the Scanning Electron Microscope (SEM). The results, however, were somewhat different from the original particle size possibly due to sample aging and agglomeration of the FeOOH Spindles. Conversely, the Nanorod dimensions obtained from the Prolate Ellipsoid Model differed by a factor 1.2-2 from the values obtained by Transmission Electron Microscopy and SEM. The significant difference between DDLS and imaging results is due to the nature of the modeling employed (ellipsoid was used to model cylindrically shaped particles with spherical caps).