Multi polarization dynamic light scattering of non-spherical nanoparticles in solution

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Application of dynamic light scattering (DLS) for sizing of non-spherical nanoparticles using co polarized and cross-polarized components of the scattered light is limited by the difficulties of measurement of very weak cross-polarized light intensity and problems with inverting of the scattering data into direct prediction of nanoparticles size parameters. Here we propose the new technique, called multi polarization DLS, based on time-resolved measurements of the scattered light intensity at different angles between the incident and scattered light polarizations. The physical model giving the relation between particle's translational and rotational diffusion coefficients and intensity autocorrelation function (ACF) for the arbitrary angle between the incident and scattered polarizations is developed. Numerical algorithm for the inverse problem of calculating the diffusion coefficients from the family of ACFs is introduced, and a semi empirical approach for length and diameter estimation of quasi-cylindrical nanoparticles from the diffusion coefficients is proposed. The application to Au and Fe2O3 Nano rods, in particular to monitor the selective etching-induced size changing, is described. In comparison with depolarized DLS, the method allows one to avoid measurement of the very weak cross-polarized component of the scattered light, and gives more data for solving the inverse problem of size parameter reconstruction from the scattered light intensity.

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