Poster Presentation

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Depolarized Dynamic Light Scattering a method to analyse Particle Shape and Size

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Dynamic Light Scattering (DLS) is already a widely used method for small particle size distribution analysis [1]. The main purpose of this method is the determination of particle sizes, respectively the hydrodynamic radius in the sub-microscopic range, i.e. 1 nm up to few µm. It is based on the Brownian motion of those particles. Light scattering methods are non-invasive and therefore a great advantage in the field of particle analysis [2a]. The next generation of Dynamic Light Scattering devices will apply depolarized dynamic light scattering (DDLS) [2b]. This technique allows to obtain beside radius distributions also information about the particle shape. However, for some time technical drawbacks made it almost unfeasible to use it for biological samples. In cooperation with the University of Hamburg we developed the first experimental set-up of a DDLS system to be used in the laboratory to analyze and characterize protein solutions as well as suspensions of nano crystals, suitable for Free-Electron-Laser applications. The fundamental difference to so far known "standard" DLS is that the scattered light is separated into two signal pathways, a vertically and a horizontally polarized component, applying a special designed beam splitter. DDLS allows to measure the translational diffusion and the rotational constants simultaneously. Both constants are derived from the decay times of the autocorrelation functions. With the equations of Perrin the system is capable of calculating the axis ratio of the particles, approximating the real particle shape as a rotational ellipsoid. For calibration and tests gold rod particles of 575 nm in length and 25 nm diameter were applied. The first biological sample, which was analyzed by DDLS was hemocyanin from Limulus polyphemus hemolymph [3a], which occurrs predominantly as hexamers, dodecamers and traces of higher aggregates occur at high pH. In summary, together with additional advantages like viscosity independent measurements and ten times higher resolution compared to DLS, the DDLS-technique is optimal to characterize biological samples to be used for crystallization experiments and to score solutions and suspensions of nano-crystals to be used for Free-Electron Laser applications [3b].

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