Hydrodynamic Radii of Quantum Dots Determined by Quasi Elastic Light Scattering (QELS)

Quantum dots, which are really semiconductor nanoparticles, have size, shape, and dopant dependent optical and electrical properties that have increasingly made them attractive for a variety of applications such as sensors, biological imaging, and investigation of cellular mechanisms.

Such effects are most prominent in the size range of 1-10 nm, due to quantum confinement of the electronic energy levels. We use WyattQELS measurements attached to a DAWN EOS to measure the hydrodynamic radius of the Quantum dots.

Typical measurements with other contemporary techniques of size distribution are tedious and use destructive methods. Moreover, it is important to have a technique that can measure the size of quantum dots in the reaction media *without* the need for their isolation to facilitate rapid optimization and fine tuning of the synthetic procedures.

We have performed QELS measurements to determine the size of these Quantum dots and determine the hydrodynamic radius (R_h). Measurements were performed with samples in scintillation vials using the detector 13 in the DAWN EOS set up and data was analyzed using the ASTRA software.

The Rh values of 1.6 - 2.0 nm were determined for undoped and doped ZnS quantum dots synthesized in aqueous micellar media.. These values are essentially same as the average radius of 1.9 nm determined by transmission electron microscopy (TEM).

Our study demonstrates that QELS can be used as a rapid, reliable and convenient method for the determination of size of nanoparticles/Quantum dots even up to the lower limits of 1-2 nm.

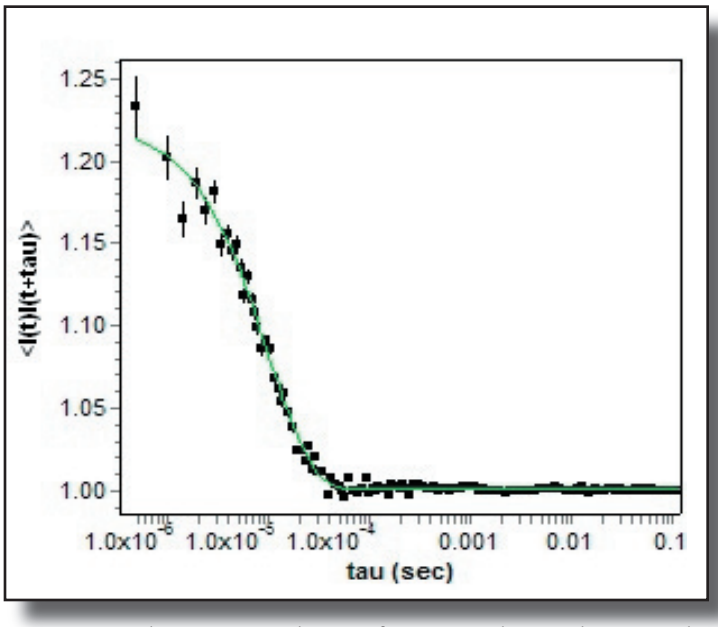

Figure 1. The autocorrelation function obtained using the ZnS Quantum dot doped with manganese using the batch method.

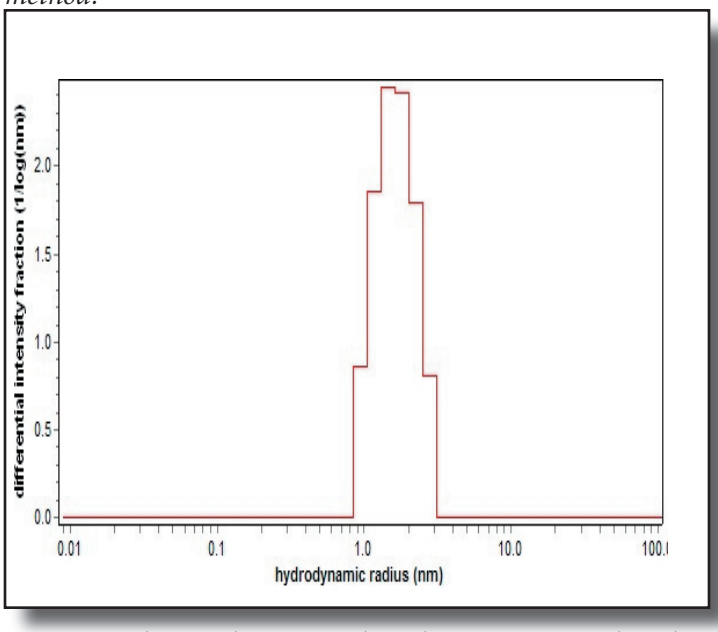

Figure 2. The regularization data depicting a size distribution.

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