ESRF	**Experiment title:** **Nanoflakes of semiconductor nanorod particles**	**Experiment number:** **26-02-638**
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Shifts: 9	**Local contact(s):** Dr. Giuseppe Portale	*Received at ESRF:*

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Report:

This experiment was designed to obtain better insight into the behavior of colloidal nanorods in a liquid dispersion and from that to provide a more detailed view of the effects observed in a previous experiment by Pietra et al. (expt. SC-3300) [1]. We successfully measured the SAXS patterns of colloidal dispersions of CdSe nanorods of different lengths, at different concentrations, in different liquid mixtures, at different temperatures. We measured with a photon energy of 12 keV (1.033 Å) and the Pilatus detector aligned for a q range from 0.02 to 1.5 nm^{-1}, to detect both the single particles and the larger structures in a single measurement.

Typical results for the temperature dependence are shown below (figures 1-3) for the three smallest CdSe nanorod sizes studied. At increasing temperatures, a clear decrease in scattering intensity is observed for the smaller q values, indicating that the concentration of larger objects in the sample is decreasing. For larger values of q ($q>0.5$ nm^{-1}), the scattering pattern is independent of temperature. Generally, this behavior can be understood in terms of a gradual disappearance of clusters of the nanorods at increasing temperatures. The larger structures fall apart into separate nanorods. Further analysis of the data has to be done to understand the details of this process. For larger rod lengths, the changes of the scattering pattern become more complicated.

To complement the measurements on elongated CdSe particles, the nanorods, we also measured the second virial coefficient of colloidal dispersions of more or less spherical PbSe particles, so-called nanodots. We measured on a series with different PbSe concentrations in round capillaries at room temperature. The obtained structure factors for the 4.4 nm nanoparticles are shown in figure 4. At increasing concentrations, a clear decrease in the structure factor is observed for small q, corresponding to a positive second virial coefficient, as expected. From extrapolation to $q = 0$, we obtained the virial coefficient, which matches our previous independent measurements using analytical centrifugation and quantitative cryo-TEM.

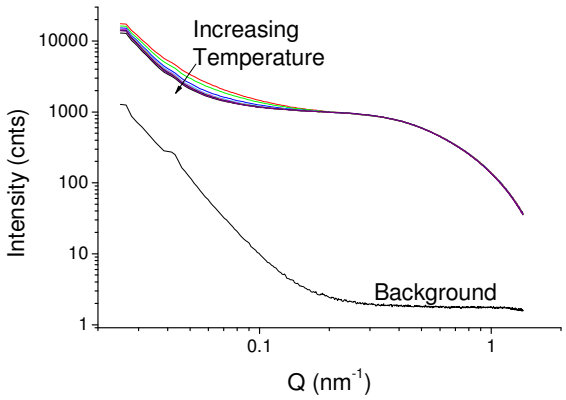

Figure 1: 13 nm CdSe nanorods.

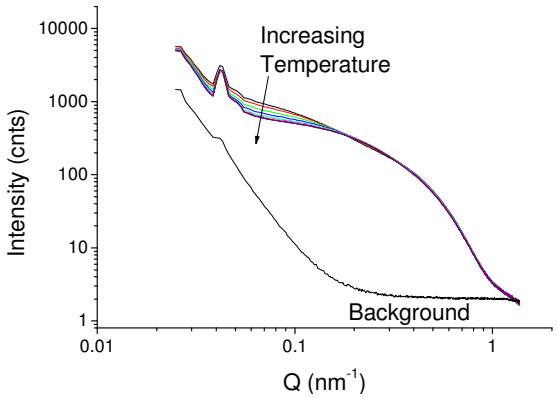

Figure 2: 26 nm CdSe nanorods.

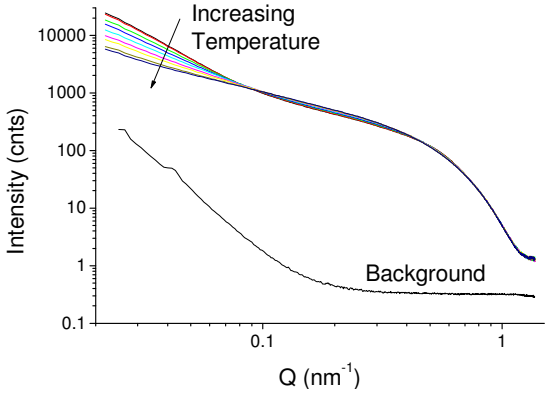

Figure 3: 49 nm CdSe nanorods.

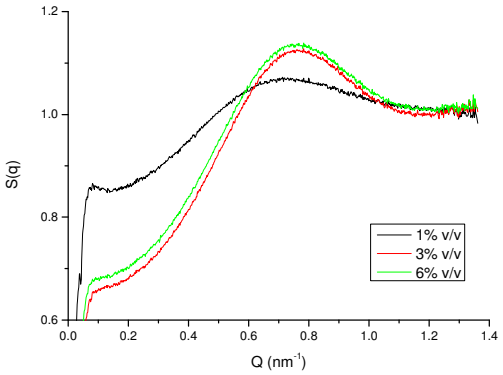

Figure 4: Structure factors for different volume fractions of 4.4 nm PbSe nanodots.

References

[1] F. Pietra et al., *Nano Lett.*, **2012**, *12* (11), 5515–5523; Report of the experiment SC-3300