Monitoring the Formation of Conductive PbS Nanocrystal Superlattices at the Liquid/Air Interface in Real Time by X-ray Scattering

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We will present a real-time study of the surface-functionalization of PbS nanocrystals (NC) with the organic semiconductor tetrathiafulvalene dicarboxylic acid (TTFDA) at the liquid/air interface. Our analysis is carried out by in-situ grazing incidence small angle x-ray scattering (GISAXS) to monitor changes in the type and lattice constant of the superlattice of NCs during ligand exchange with TTFDA. We have previously demonstrated that TTFDA-functionalized PbS superlattices are conductive and mesocrystalline, which bears new possibilities of exploiting NCs for optoelectronic applications, since the properties of such materials will not only depend on the type, size and coupling of the NCs, but also on their orientation.[1–3] To this end, a detailed understanding of the formation pathway is mandatory.

We will compare the different kinetics for ligand exchange of NC monolayers to multilayers, extract typical times of diffusion for the organic semiconductor and discuss our results in the light of other recent real-time studies of NC assembly at the liquid/air interface.[4,5] Guidelines for efficient ligand exchange of NCs at the liquid/air interface with large, bulky molecules will be provided.

References:

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