

Microstructures of dendronized CdS quantum dots

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Self-assembled quantum dots have been the subject of intensive studies from scientific and technological viewpoints because of the size-dependent photoluminescence. Recently, a new photoluminescence switching mechanism has been proposed in CdS quantum dots modified with a two-layer corona of aliphatic thiols (inner) and liquid crystal aromatic dendrons (outer) [1]. Interestingly, the dendronized nanoparticles subjected to heat treatment are self-assembled in an unexpectedly low-symmetry structure, space group $P2_13$. Although small-angle X-ray scattering indicated anisotropic distribution of dendrons in the self-assembled state, the mechanism to form the low-symmetry structure remains yet unclear. In this study, we investigated the microstructure of individual dendronized CdS nanoparticles, in both the as-prepared and heat-treated states, using transmission electron microscopy (TEM).

High-angle annular dark-field scanning transmission electron microscopy (HAADF-STEM) revealed that CdS nanoparticles are of single crystals showing the wurtzite-type structure: refer to Fig.1. The average size of CdS nanoparticles was determined to be 4 nm. In order to examine the morphology of dendrons coating the CdS nanoparticles, we have employed several methods that may be useful in observations of organic materials, i.e., annular bright-field (ABF) STEM, conventional high-resolution TEM, and electron holography. An ABF-STEM observation showed well-defined contrast due to the organic materials around CdS nanoparticles, and is accordingly promising for further examinations on the structure of dendrons with respect to the thickness and/or shape asymmetry (i.e., deviation from sphere). We shall also discuss the usefulness of the phase shift measurement by electron holography for the morphology analysis of dendrons.

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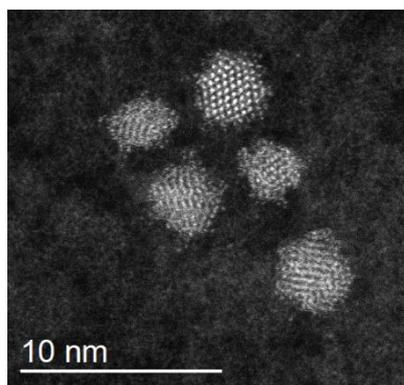


Figure 1. HAADF STEM image of dendronized CdS nanoparticles dispersed on a monolayer graphene film.