Abstract Submitted
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Morphology of Cu_2S-CdS and Ag_2S-CdS Nanorod Heterostructures[1] DENIS DEMCHENKO, Virginia Commonwealth University, BRYCE SADTLER, University of California, Berkeley, HAIMEI ZHENG, A. PAUL ALIVISATOS, LIN-WANG WANG, Lawrence Berkeley National Laboratory — A partial cation exchange has been used to synthesize Cu_2S-CdS and Ag_2S-CdS nanocrystal heterostructures, with two very different morphologies. Cu^+ cation exchange takes place preferentially at the ends of CdS nanorods, Cu_2S segments grow into the nanorod from both ends. Ag^+ exchange is non-selective, Ag_2S islands nucleate and grow over the entire surface of the nanorod. This leads to very different patterns, striped Ag_2S-CdS superlattice with several equidistant Ag_2S segments in a CdS nanorod, and an asymmetric Cu_2S-Cds heterostructure with Cu_2S segments at the ends of the CdS nanorod. We use first-principles calculations to obtain formation energies of the different epitaxial interfaces between $Cu(Ag)_2S$ and different facets of CdS nanorods. Comparison of chemical and elastic contributions to the interface formation energy for the $Cu(Ag)_2S$-CdS shows that the relative stability of the interfaces determines the nucleation of $Cu(Ag)_2S$ and the resulting morphology. Furthermore, since two end facets of CdS nanorod are not crystallographically equivalent a controlled asymmetric nucleation of Cu_2S can occur.

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