

Extending the Limit of Low Energy Photocatalysis: Dye Reduction with PbSe/CdSe/CdS Core/Shell/Shell Nanocrystals of Varying Morphologies under Infrared Irradiation

Chaewon Pak¹, Ju Young Woo¹, Kangha Lee¹, Whi Dong Kim¹, Youngjae Yoo², Doh C. Lee^{1}*

¹Department of Chemical and Biomolecular Engineering KAIST Institute for the Nanocentury,
Korea Advanced Institute of Science and Technology (KAIST), Daejeon 305-701, Korea.

²Advanced Materials Division Korea Research Institute of Chemical Technology (KRICT),
Daejeon 305-600, Korea

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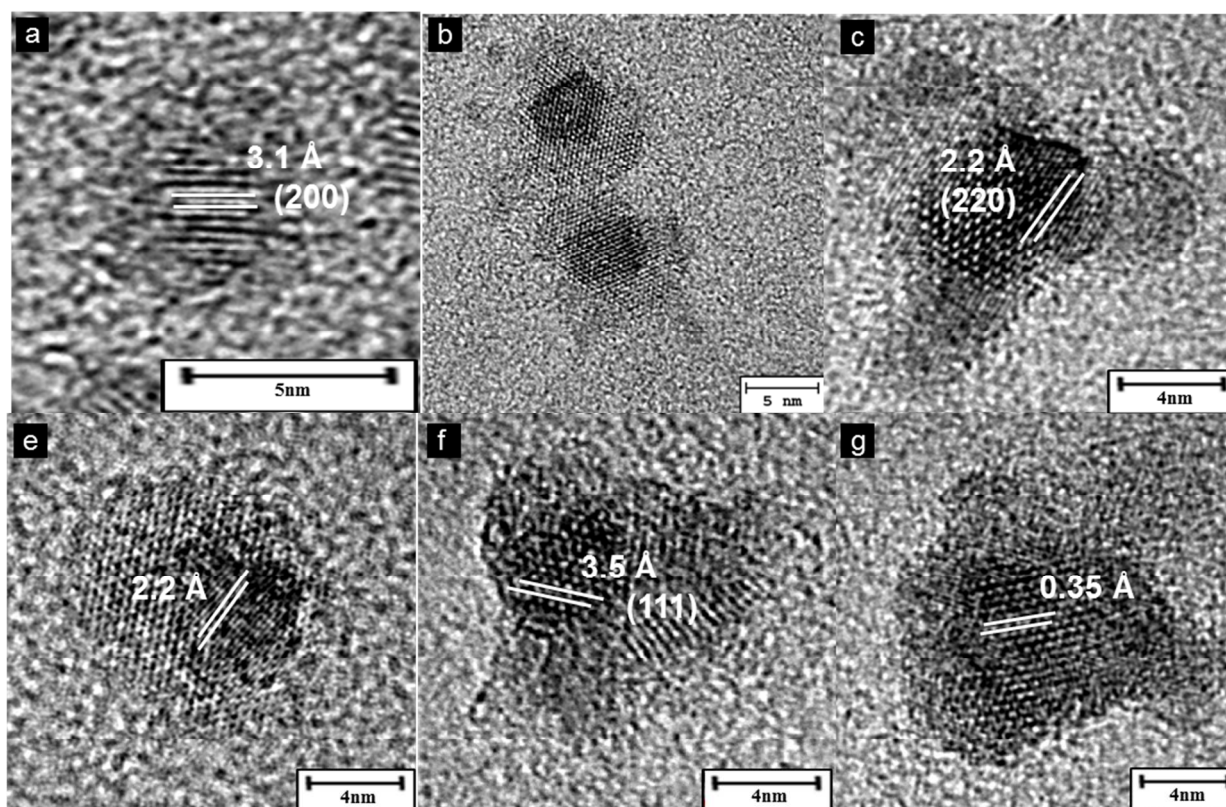


Figure S1. High-resolution TEM (HRTEM) images of (a) a PbSe/CdSe HNC and (b-g) PbSe/CdSe/CdS nanocrystals. The HRTEM images show crystalline core particles with d-spacings of 3.5 Å, 3.1 Å, and 2.2 Å, corresponding to the (111), (200), and (220) planes of the rock-salt PbSe crystal, respectively. Energy dispersive X-ray spectroscopic analysis reveals that the atomic ratio of Pb: Cd: Se: S in the sample is approximately 7:54:9:30.

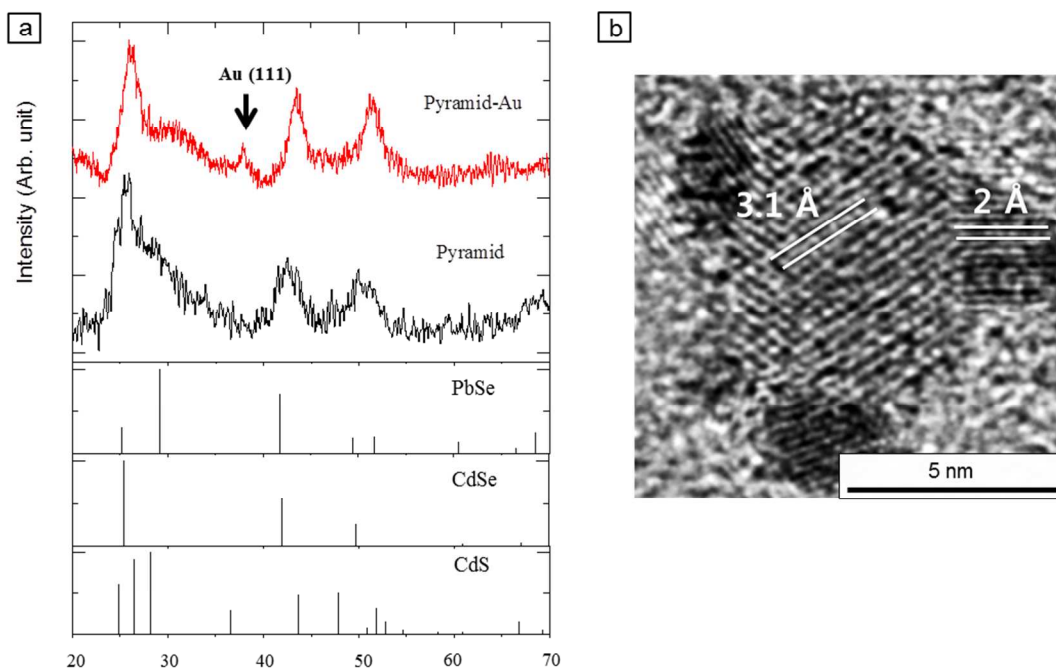


Figure S2. (a) TEM image of a single pyramidal HNC with Au tips. Lattice spacings that match CdS and Au are observed at the core and tips, respectively. (b) XRD pattern of PbSe/CdSe/CdS pyramid HNCs with (top) and without (bottom) Au tips. Peaks from PbSe, CdSe and CdS are marked. A peak at 38° corresponding to (111) plane of fcc Au appears after the Au tip growth.

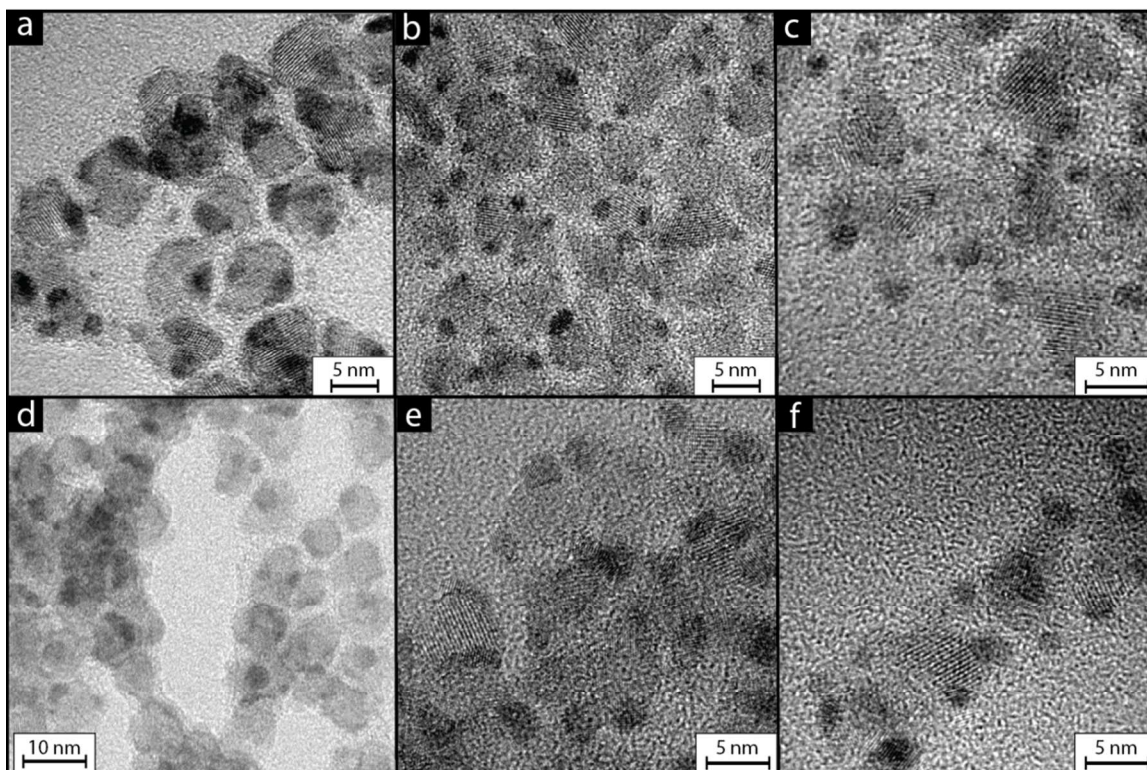


Figure S3. TEM images of Au-tipped PbSe/CdSe/CdS HNCs synthesized in aqueous solution (a-c) before and (d-f) after photocatalytic reaction: (a, d) spheres, (b, e) pyramids, and (c, f) tetrapods. The HNCs undergo little morphological change during the photocatalysis.

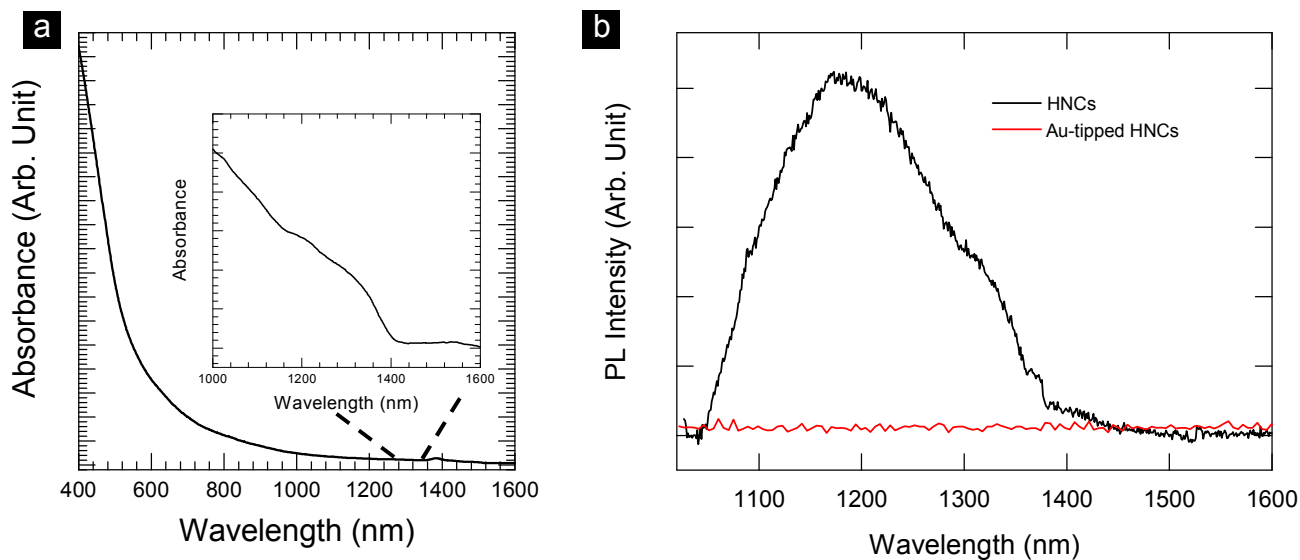


Figure S4. (a) Absorption spectrum of Au-tipped PbSe/CdSe/CdS heterostructure nanocrystals. Inset shows zoomed-in region at near-infrared, in which a shoulder peak appears at the spectrum. (b) Photoluminescence (PL) spectra of PbSe/CdSe/CdS heterostructure NCs before (black) and after (red) Au tip growth. PL intensity was normalized with optical density at the excitation wavelength (785 nm).