

Selective Growth of Metal and Binary Metal Tips on CdS Nanorods

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Supporting Information

Synthesis and Characterization

CdS nanorods were prepared by heating CdO (0.23 g), trioctylphosphine oxide (7 g), and tetradecylphosphonic acid (0.83 g) at 300°C for 15 minutes. The temperature was raised to 320°C and a solution of S (0.18 g) dissolved in trioctylphosphine (16 mL) was injected before decreasing the temperature to 300°C. The reaction mixture was heated for 45 min, cooled, and then precipitated with methanol and separated by centrifugation.¹

The reaction conditions for metal reduction were similar to those described previously.² Oleic acid (0.2 mL), oleylamine (0.2 mL), and 1,2-hexadecanediol (43.0 mg) were heated in diphenyl ether (10 mL) at 80°C under vacuum for 30 min to remove traces of water. Pt acetylacetonate (65.5 mg) was added to a suspension of CdS rods in dichlorobenzene and heated at 65°C for 10 min to promote dissolution of the Pt precursor. The mixture of surfactants and diphenyl ether was purged with nitrogen and heated to 200°C before injecting the Pt precursor and semiconductor rods. After several min. the reaction was removed from heat and quenched in a water bath. The product was washed twice by precipitation in ethanol followed by centrifugation, and then separated twice by centrifugation. Various amounts of Ni or Co acetate (equimolar to Pt) could be added to the reaction prior to heating to 80°C to promote PtNi or PtCo formation at the tips. Nanoparticle size and composition was altered by decreasing the concentration of the metal precursors.

The structure and composition of the samples were investigated by TEM (Tecnai G2 S-Twin microscope operated at 200 kV), HRTEM and EDS (Philips CM200/FEG microscope operated at 200 kV, equipped with a Link EDS detector), and XRD (Bruker-AXS D8 with a general area detector and Co K α radiation). Samples were dispersed on carbon coated copper grids for TEM or silicon substrates for XRD. Metal nanoparticle tip sizes were determined by measuring across the longest axis.

References

- (1) Shieh, F.; Saunders, A. E.; Korgel, B. A. *J. Phys. Chem. B*, **2005**, *109*, 8538.
- (2) Ahrenstorf, K.; Albrecht, O.; Heller, H.; Kornowski, A.; Gçrlitz, D.; Weller, H. *Small*, **2007**, *3*, 271.

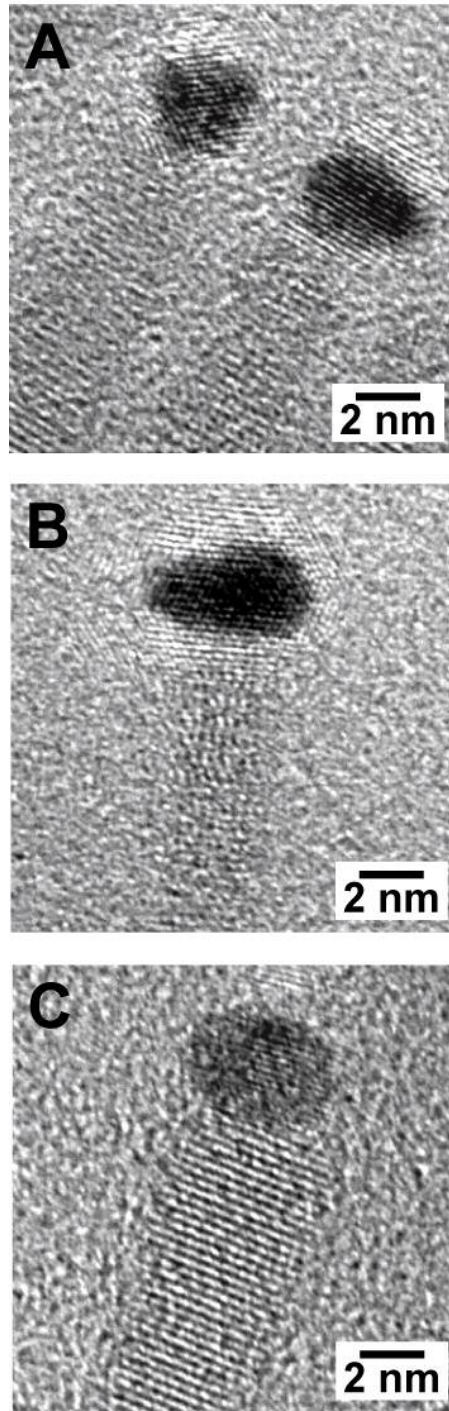


Figure S1. Enlarged HRTEM images of (A) Pt-CdS, (B) PtNi-CdS, and (C) PtCo-CdS heterostructures.

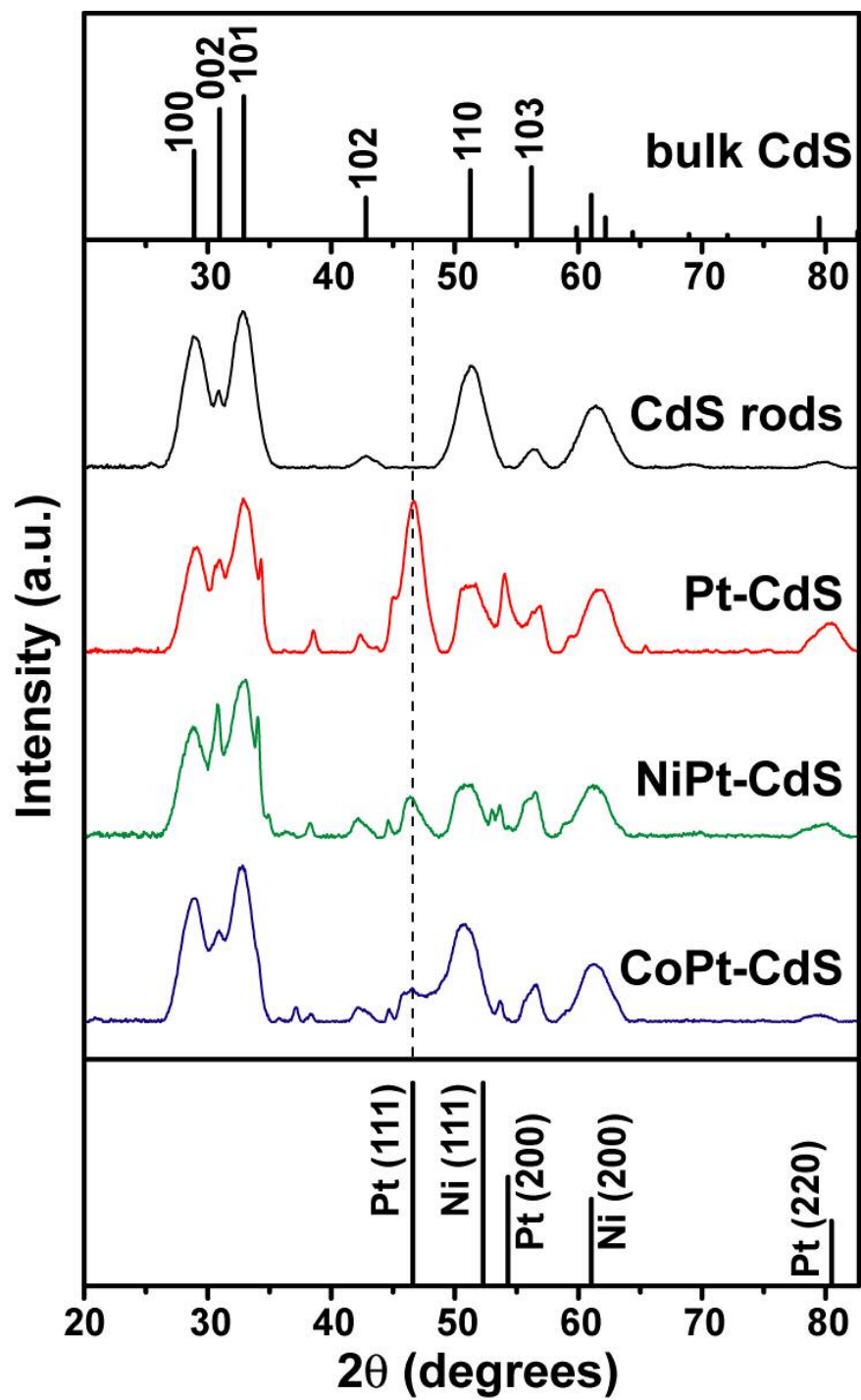


Figure S2. Complete set of XRD spectra for pure CdS nanorods, and heterostructures of CdS-Pt, CdS-PtNi, and CdS-PtCo, with bulk diffraction values for pure CdS, Pt, and Ni.