Shaping binary metal nanocrystals through epitaxial seeded growth

Susan E. Habas,[1, 2] Hyunjoo Lee,[1,2] Velimir Radmilovic,[2] Gabor A. Somorjai,[1, 2] and Peidong Yang[1,2]

[1]Department of Chemistry, University of California, Berkeley
Berkeley, California 94720

[2]Materials Sciences Division, Lawrence Berkeley National Laboratory
1 Cyclotron Road, Berkeley, California 94720

e-mail: p_yang@berkeley.edu

Supporting information

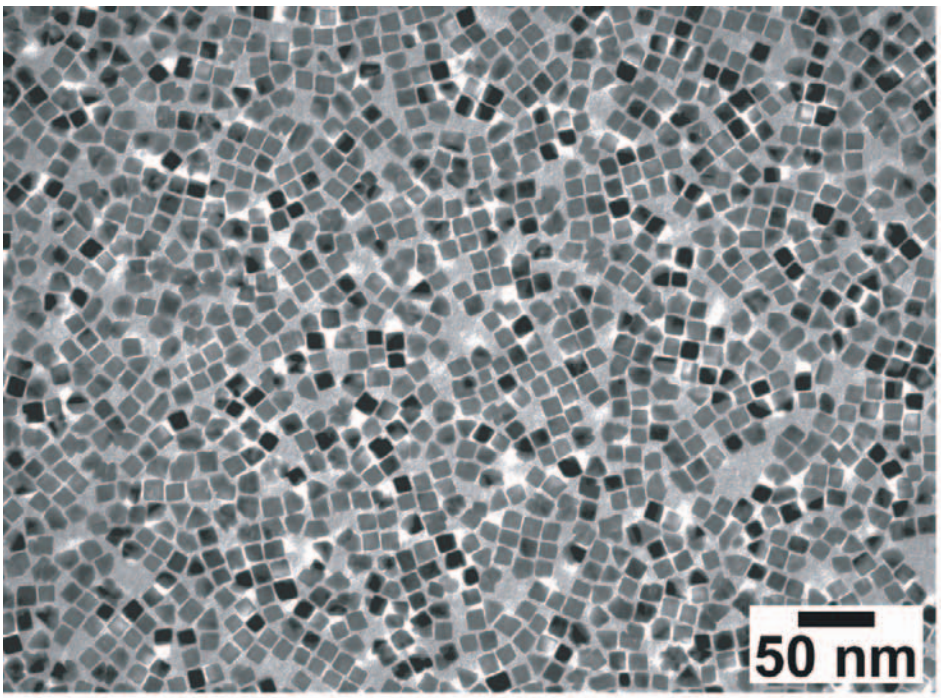
Figure S1: TEM image of the Pt nanocubes used as seeds for the directed epitaxial overgrowth of a secondary metal.

Figure S2: Control experiments for the reduction of Pd on cubic Pt seeds in the absence of seeds (a), and with small spherical Pt seeds (3.5 nm) (b and c). The TEM images in (b) and (c) show that Pd overgrowth on small Pt seeds in the presence of 1 mM HNO_3 and 1 mM aqua-regia, respectively, does not allow for controlled growth along the {100} and {111} directions as seen for the cubic Pt seeds to give cubes and octahedra.

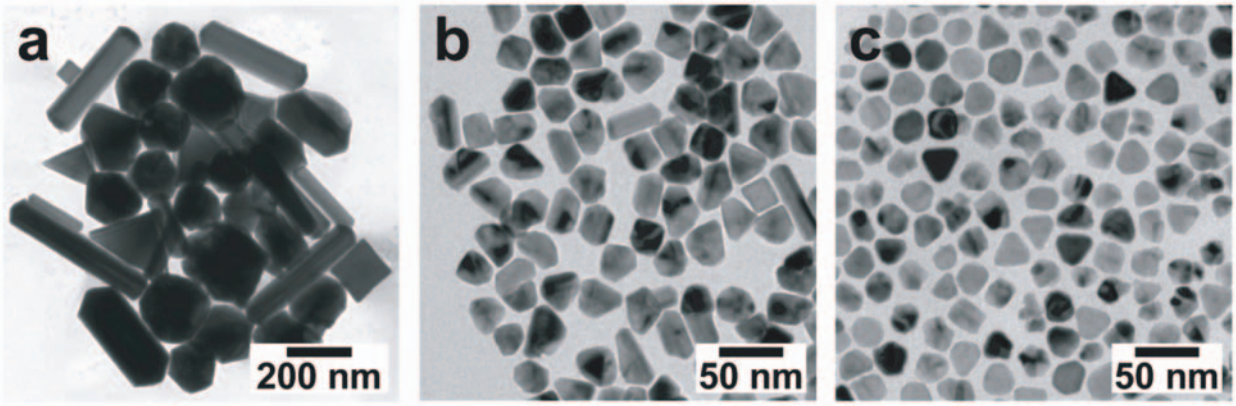
Figure S3: Conformal epitaxial overgrowth of Pd shells on cubic Pt seeds shown at early stages of growth indicating the orientation of the cubic seed within a Pd cube (overview shown in **a**, high-magnification in **b**), cuboctahedron (c), and octahedron (d). Imaging was performed slightly off-axis to enhance the contrast between the Pt core and the Pd shell. The corresponding SAED patterns (taken on-axis, insets b-d) show that each particle is oriented along the <100> zone axis.

Figure S4: Pd octahedral shells grown on cubic Pt seeds using NO_2 gas rather than aqua-regia as an NO_2 source, indicating that NO_2 is the active component of the aqua-regia

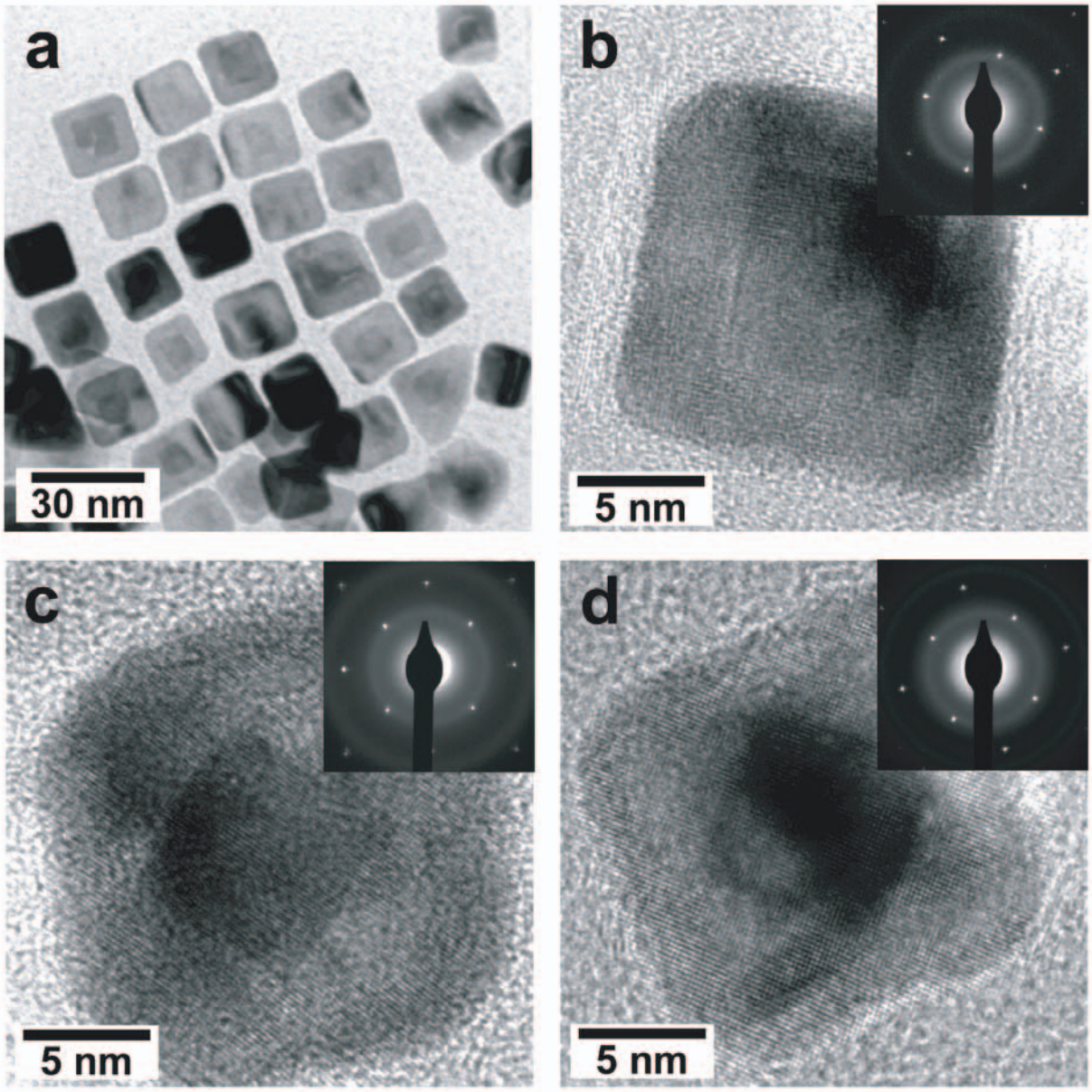
which is used here to confer shape control during the epitaxial overgrowth of Pd on the Pt nanocubes.



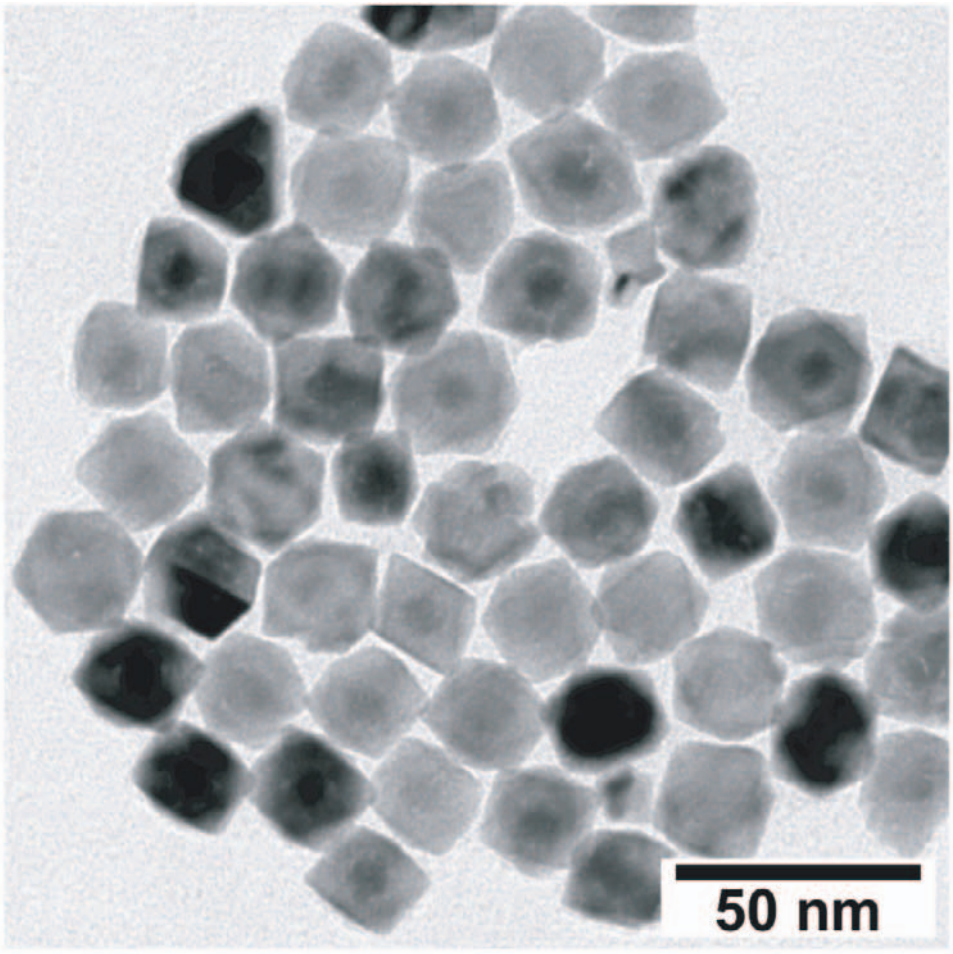
Supplementary Information Figure S1, P. Yang



Supplementary Information Figure S2, P. Yang



Supplementary Information Figure S3, P. Yang



Supplementary Information Figure S4, P. Yang