Reaction mechanism of "Amine-Borane Route" towards Sn, Ni, Pd, Pt nanoparticles

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The supplementary information reports on the characterization of Sn nanocrystals, X-Ray Photoelectron spectroscopy (XPS) (Figure S1) and electron dispersive spectroscopy (EDS) on several areas of a single nanocrystal (Figure S2). The X-Ray diffractions of the Ni, Pd and Pt nanocrystals are reported in Figure S3.

In order to identify the amorphous phase of the Sn surface (the oxide layer), XPS measurements were done (Figure S1). Tin can display three oxidation states corresponding to the following binding energy values: Sn⁰ (485.0 eV), Sn^{II} (485.9 eV) and Sn^{IV} (486.6 eV) (as taken from NIST data base). The spectrum can be fitted with a main component (91%) centered at 486.8 eV (Sn^{IV}) and a small component (9%) at 484.7 eV (Sn⁰). Such a spectrum is typical of metallic tin with an SnO₂ oxide shell.



Figure S1: X-Ray Photoelectron spectroscopy (XPS) of Sn nanocrystals

The XPS results are supported by energy dispersive X-ray spectroscopy (EDS) (Figures S2b and S2c) of a single nanoparticle (Figure S2a). The EDS results show an increase of oxygen/tin atomic ratio from the core to the shell of the nanocrystal. No other element has been analyzed and the nanoparticle shows more oxygen on the surface (spot 2) than on the core (spot 3) (see table). The analysis is consistent with the findings of the XPS.



Figure S2: TEM image of Sn nanoparticles analyzed by EDS (a). EDS corresponding to spot 3 (b) and spot 2 (c)

Element Line	Atomic %	Atomic %
	Spot 3	Spot 2
ОК	7.44	9.94
Sn L	92.56	90.06
Total	100.00	100.00

The reaction of DMAB with $Pd(acac)_2$ precursor yields crystalline Pd NPs of 8±5nm with FCC crystalline structure corresponding the bulk (JCPDS # 05-0681) and cell parameter a=b=c= 3.8898 Å (Figure S3a).



Figure S3a: X-Ray Diffractogram of Pd nanoparticles with FCC crystalline structure

The reaction of DMAB with $Pt(acac)_2$ precursor yields crystalline Pt NPs of 5±3nm with a bulk crystalline structure corresponding to (JCPDS # 01-087-0975) and cell parameter a=b=c= 3.9380 Å (Figure S3b).



Figure S3a: X-Ray Diffractogram of Pt nanoparticles with FCC crystalline structure

The reaction of DMAB with $Ni(acac)_2$ precursor yields crystalline Ni NPs of 5±2nm according to the TEM and electron diffraction. The XRD of dry Ni nanopowder was collected in air and the sample only displays a very weak peak corresponding to the [111] reflection of face-centered cubic Ni (Figure S3c).



Figure S3a: X-Ray Diffractogram of Ni nanoparticles oxidized in air