Electronic Supplementary Material (ESI) for RSC Advances

Supporting information

Hua Y. Si, Du Yuan, Jing S. Chen and Gan M. Chow*

Department of Materials Science & Engineering, National University of Singapore Singapore 117540, Republic of SingaporeState

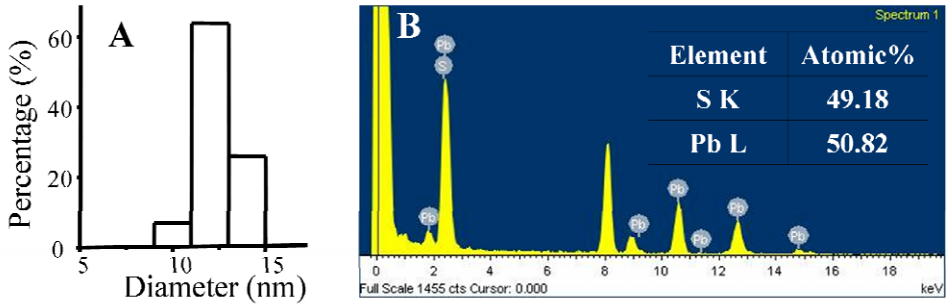

Figure S1 (A) size distribution of the obtained 12 nm NCs and (B) EDS spectrum of the PbS.

Figure S1A is the size distribution of the obtained nanoparticles determined by Figure 1A. Relative standard deviation of the size of the PbS NCs with 12 nm average diameters is about 5%, indicating the obtained PbS NCs are highly monodispersed. The EDS analysis reveals the Pb/S atomic ratio to be about 1/1, which agrees well with the PbS atomic ratio.

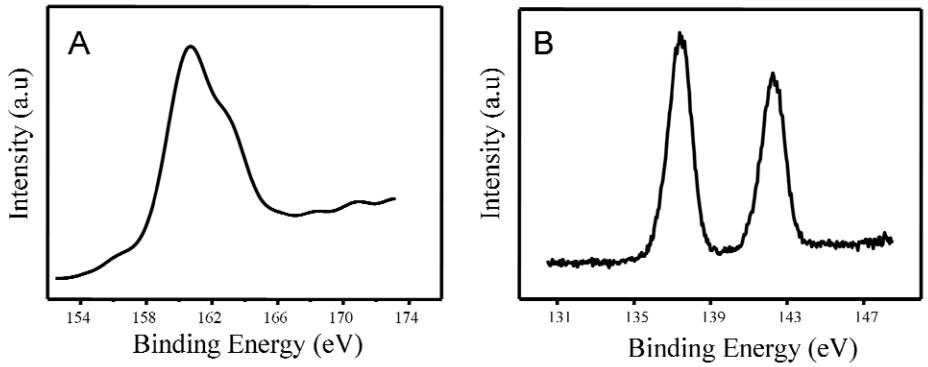

Figure S2 XPS spectra: (A) S 2p region and (B) Pb 4f region of the PbS NCs

The composition of the samples was identified by X-ray photoelectron spectra (XPS). The XPS of Pb 4f region and S 2p region are shown in Figure S2 (A) and (B). The peaks at 137.07 eV and 141.07 eV belong to the binding energy of Pb 4f 7/2 and

Pb 4f 5/2, respectively [1]. The doublet structure of S 2P 2p is characterized by peaks centered at 160.24 and 161.29 eV. These binding energy values are close to those of the PbS bulk crystal [2]. No peaks apart from Pb, S, C and O were detected.

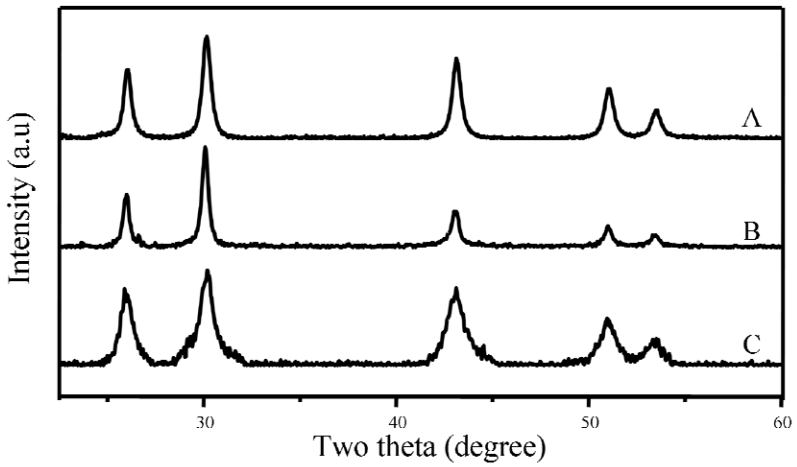

Figure S3 X-ray diffraction patterns of (A) oleylamine, (B) dodecylamine and (C) octylamine capped PbS NCs structure.

More evidence for the PbS NCs' crystallinity is provided by the powder X-ray diffraction (XRD) measurement. The XRD patterns of PbS NCs are shown in Figure S3. XRD patterns of PbS NCs agree well with PbS bulk with rock salt crystal structure. Average particle size information is also obtained applying the Scherrer equation to the line broadening of the (200) peak. The crystalline sizes are estimated as 12.5 nm for the cubic PbS NCs, which is consistent with the results from TEM images. With decreasing the length of alkylamine, the peaks shape of PbS NCs became widen, which indicates the size of NCs turned decreased.

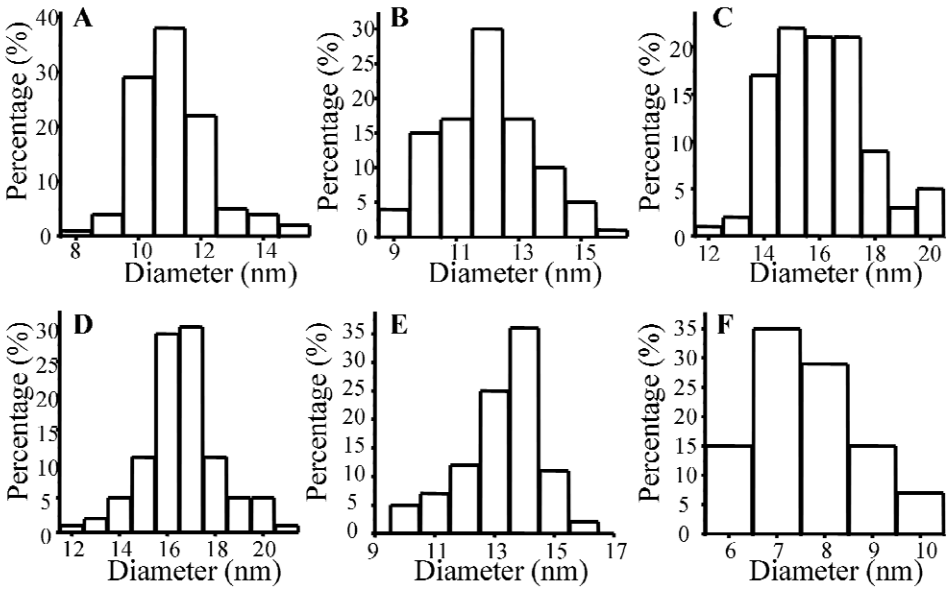

Figure S4 The size distribution histogram of Figure 2. The average size of (A) 10 nm; (B) 12 nm; (C) 16 nm; (D) 16 nm; (E) 13 nm; (F) 7 nm.

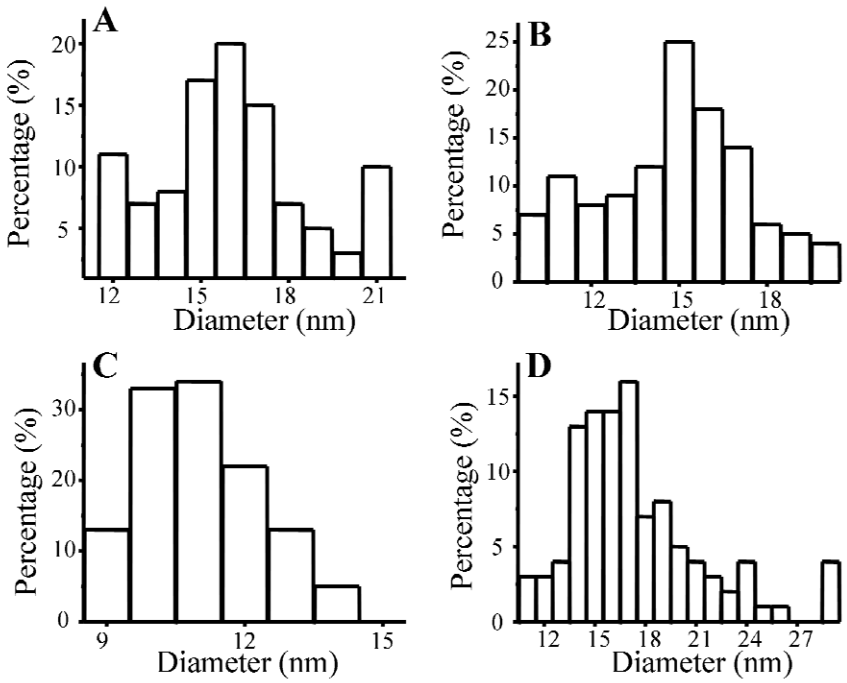

Figure S5 The size distribution histogram of Figure 3. The average size of (A) 16 nm; (B) 15 nm; (C) 11 nm; (D)18 nm.

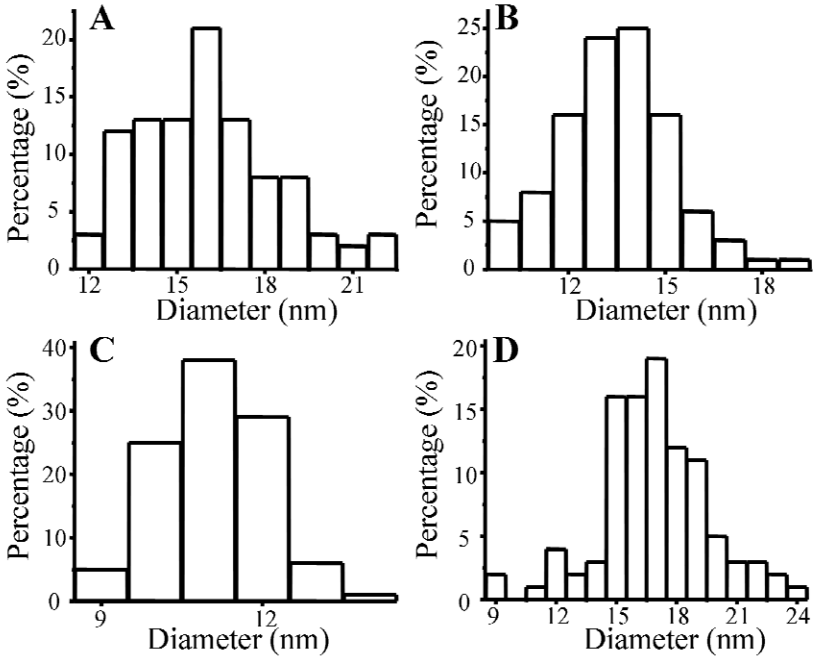

Figure S6 The size distribution histogram of Figure 4. The average size of (A) 16 nm; (B) 13 nm; (C) 11 nm; (D)17 nm.

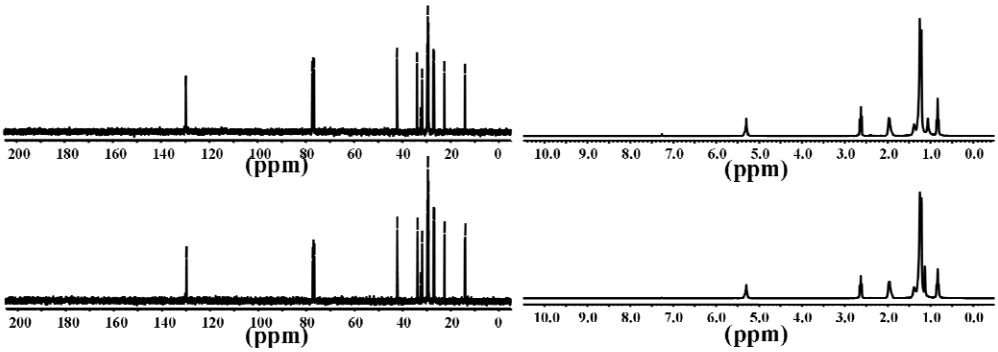

Figure S7 (Left) ^{13}C NMR spectrum and (right) ^{1}H NMR spectrum for the OA (top) and S:OA solution (bottom) at room temperature for 0.5 h.

Pb^{2+} (mol/L)	S^{2-} (mol/L)	alkylamine (10 mL)	water volume (mL)	reaction time (min)	size of PbS (nm)	dispersity
0.08	0.08	oleylamine	2.5	15	9	1.22
0.08	0.08	oleylamine	2.5	20	12	1.54
0.08	0.08	oleylamine	2.5	30	16	1.70
0.008	0.08	oleylamine	2.5	20	16	2.97
0.04	0.08	oleylamine	2.5	20	15	2.69
0.16	0.08	oleylamine	2.5	20	18	4.04
0.08	0.08	oleylamine	0.5	20	16	2.34
0.08	0.08	oleylamine	1	20	13	1.74
0.08	0.08	oleylamine	5	20	17	2.86
0.08	0.08	dodeylamine	2.5	30	13	1.59
0.08	0.08	octylamine	2.5	30	7	1.04

Table 1 Summarizing the conditions of each reaction and the average diameter and dispersity of the resulting nanoparticles.

Reference

1. Lobo, A.; Moller, T.; Nagel, M.; Borchert, H.; Hickey, S. G.; Weller, H., *J. Phys. Chem. B* **2005,** 109, 17422.
2. Smart, R. S. C.; Skinner, W. M.; Gerson, A. R., *Surf. Interface Anal.* **1999,** 28, 101.