Supporting Information

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Synthesis of Diameter-Tunable CdTe Nanotubes Templated by 1-Dimensional Nanowires of Cadmium Thiolate Polymer

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The formation of 1-D helical nanowires of Cd-TGA was followed by both TEM and powder X-ray diffraction. Figure 1S presents the morphology evolution of Cd-TGA complexes during the reflux. The Cd/S atomic ratios determined by XPS were also inserted.

Figure S1. Cd-TGA complexes formed before (a) and after being refluxed for 0.5 (b), 1 (c), 2 (d) and 3 hrs, respectively.
The crystalline structures of the samples shown in Figure S1 were also analyzed by powder X-ray diffraction (XRD). Before reflux, the Cd-TGA complexes present two very broad diffraction peaks in 2θ ranges of 15-35 degree and 35-60 degree, respectively, suggesting that the Cd-TGA possesses a kind of amorphous structure with very tiny ordering regions, or crystal seeds in it. However, the amorphous Cd-TGA became crystallized 0.5 hours after reflux. Prolonged reflux just slightly narrows the diffraction peaks due to the growth of ordering domains (nanowires) and finally leads to the linear precursors shown above.

In huge contrast, the XRD patterns of the samples synthesized in the presence of PAA (samples 2 and 3 shown in Figures 1b and 1c, respectively) do not exhibit much difference from that obtained in the absence of PAA prior to reflux, even though these two samples were obtained after being refluxed for 3 hours (see the lower frame in Figure S2). These similarities strongly suggest that Cd-TGA chains were cross-linked by PAA by inter-molecular interactions. Consequently, the diameter of the final 1-D precursors was effectively tuned against the feeding amount of PAA. Nevertheless, PAA did not encourage the crystallization of Cd-TGA complexes due to the fact that PAA together with additional cadmium ions were interdigitated into 1-D ordering structures of Cd-TGA.

The preparations of CdS nanotubes were performed as follows. Cd-TGA nanowires were firstly prepared in the presence of PAA. The concentration of Cd\(^{2+}\) was 6.5×10\(^{-3}\) M. The Cd:TGA:AA ratio was set to 1:1:0.1. After being refluxed for 3 hours, the nanowires...
were thoroughly washed for several times with neutral water and then re-dispersed into 20 mL pure water. The general morphology of the precursors can be seen in Figure S1a. Subsequently, 1.3 mL 0.1 M Na$_2$S aqueous solution was introduced. The reaction took place immediately and turned the color of the mixture to yellow. The CdS nanotubes shown in Figure S3b were obtained 2 hours later.

The preparations of HgS nanotubes were carried out by introducing 0.325 mL 0.2 M HgCl$_2$ aqueous solution into 10 mL aqueous dispersion of the as-prepared CdS nanotubes. The cation exchange reaction changed the color of the dispersion into dark grey. Usually, the reaction was allowed to take place for 5 hours. Figure S3c presents the typical tubular structures of HgS.

The crystalline structures of the CdS and HgS nanotubes were characterized by electron diffraction. The results demonstrated that both CdS and HgS are in cubic structure.

Figure S3. TEM images of the 1-D Cd-TGA precursors (a), CdS nanotubes (b) and HgS nanotubes (c). The $d$ spacings calculated from the diffraction rings for CdS nanotubes are 3.355 Å, 2.058 Å and 1.774 Å, which are in good agreement with the reported $d$ spacings for lattice planes (111), (220) and (331) of cubic (zinc blende) CdS, respectively; The experimental $d$ spacings for HgS nanotubes are 3.370 Å, 2.889 Å, 2.071 Å and 1.769 Å, corresponding to lattice planes (111), (200), (220) and (331) of cubic HgS, respectively.
The effect of the Cd to TGA ratio on the formation of 1-D helical nanowires was systematically investigated. In detail, four different samples of the Cd-TGA complexes were prepared by Cd:TGA ratios of 2:1, 1:1, 1:1.5, and 1:2.4, respectively. For comparison, the concentrations of Cd$^{2+}$ ions in all these four systems were fixed at 6.5×10^{-3} M. After reflux for 3 h at pH 11, white powder samples were collected and subjected to TEM characterizations. The results are shown in Figure S4.

![Figure S4. Cd-TGA complexes formed by Cd$^{2+}$: TGA ratios of 2:1 (a), 1:1 (b), 1:1.5 (c) and 1:2.4 (d), respectively. All above images were taken under the same magnification.](image)

![Figure S5. Electron diffraction patterns of the sample shown in Figure 2c.](image)