Ambient Pressure Synthesis of Size-Controlled Corundum-Type In$_2$O$_3$ Nanocubes

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Figure S1. Wide area TEM image of 10 nm $h$-In$_2$O$_3$ nanocubes.
Figure S2. XRD pattern of 10.2 ± 1.5 nm h-In$_2$O$_3$ nanocubes.

Figure S3. X-ray diffraction pattern of In(O)(OH) nanoparticles (JCPDS card no. 17-0549).

Figure S4. TEM image of In(O)(OH) nanoparticles.
Figure S5. TGA graph of In(O)(OH) nanoparticles.

Figure S6. XRD pattern of c-In$_2$O$_3$ nanoparticles from thermal decomposition of In(O-iPr)$_3$.

Figure S7. TEM image of c-In$_2$O$_3$ nanoparticles from thermal decomposition of In(O-iPr)$_3$.
Figure S8. UV absorption spectra of $h$-In$_2$O$_3$ nanocubes and surfactant (5/1 oleylamine/oleic acid) mixture.

Figure S9. PL spectra of $h$-In$_2$O$_3$ nanocubes and surfactant (5/1 oleylamine/oleic acid; the concentration denotes combined molar concentration) mixture excited with 290nm light. The PL signals of $h$-In$_2$O$_3$ nanocubes are easily distinguished from the signals of surfactants. In our samples of $h$-In$_2$O$_3$, PL from surfactants on the surface of the nanocubes is negligible.
Figure S10. PL spectra of surfactants at various concentration (5/1 oleylamine/oleic acid; the concentration denotes combined molar concentration), excited with 290 nm light. The PL spectra of surfactants remain consistent regardless of the concentration.
Comment about the role of size homogeneity for 2D lattice formation: In the initial phase of this work when the reaction condition was not optimized and thus the products sometimes had a broad size distribution, only small 2-D superlattice blocks would be fabricated on the TEM grid by employing the same TEM grid preparation method. Analyzing these blocks, we could judge that the maximum standard deviation allowed for the formation of 2-D superlattice is around 16%.

Figure S11. role of size homogeneity for the formation of 2-D superlattice in a sample with a broad size distribution (10.2 ± 1.9 nm). Note the much smaller 2-D superlattice size for this sample as compared to Figure s1 in which nanoparticles have a better size homogeneity. The largest standard deviations within the superlattice blocks are around 16%, smaller than 19% of the whole sample. Also, note that nanoparticles in each block are somewhat size-focused, further indicating the importance of size homogeneity in the formation of superlattice.