Facile Thermolysis Synthesis of $CuInS_2$ Nanocrystals with Tunable Anisotropic Shape and Structure

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The development of controllable synthetic strategies, along with a better understanding of the formation mechanism of individual anisotropic shapes, can enable us to rationally tailor the shape, structure, and properties of nanocrystals. For the first time we report on the general synthesis of monodisperse $CuInS_2$ (CIS) anisotropic nanocrystals by the injection of novel metal-oleate precursors into hot organic solvents. An understanding of the formation mechanism of CIS has enabled us to tailor anisotropic shapes in the form of triangular-pyramid, circular cone, bullet-like rods, and nanorods (Figure 1) with tunable crystal phases (Figure 2) by varying the synthetic conditions. The colloidal CIS nanocrystals exhibit strong fluorescence emission.

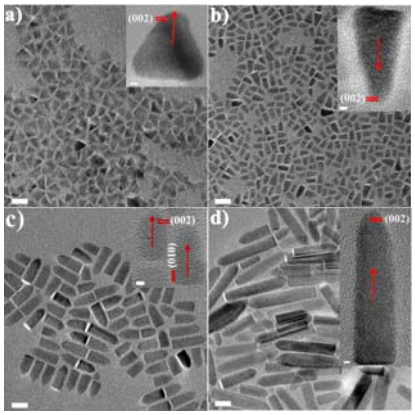

Fig. 1 TEM and HRTEM (inset) images of a) triangular pyramidal, b) conical, and c) short and d) ultra-long bullet-like CIS nanocrystals. All scale bars in the figures and insets represent 20 and 2 nm, respectively. The arrows indicate the c-axis (001) of the wurtzite structure oriented along the long axis of the crystals.

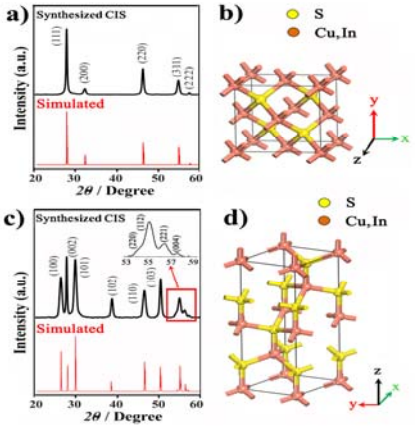

Fig. 2 a) XRD pattern of synthesized CIS nanocrystals and the simulated reference pattern (in red) for zinc blende CIS. b) Representative crystal structure of zinc blende CIS. c) XRD pattern of synthesized CIS nanocrystals and the simulated reference pattern (in red) for wurtzite CIS. d) Representative crystal structure of wurtzite CIS.