Cadmium Molybdate Octahedral Nanocrystals: Coprecipitation Controllable Synthesis and Characterization

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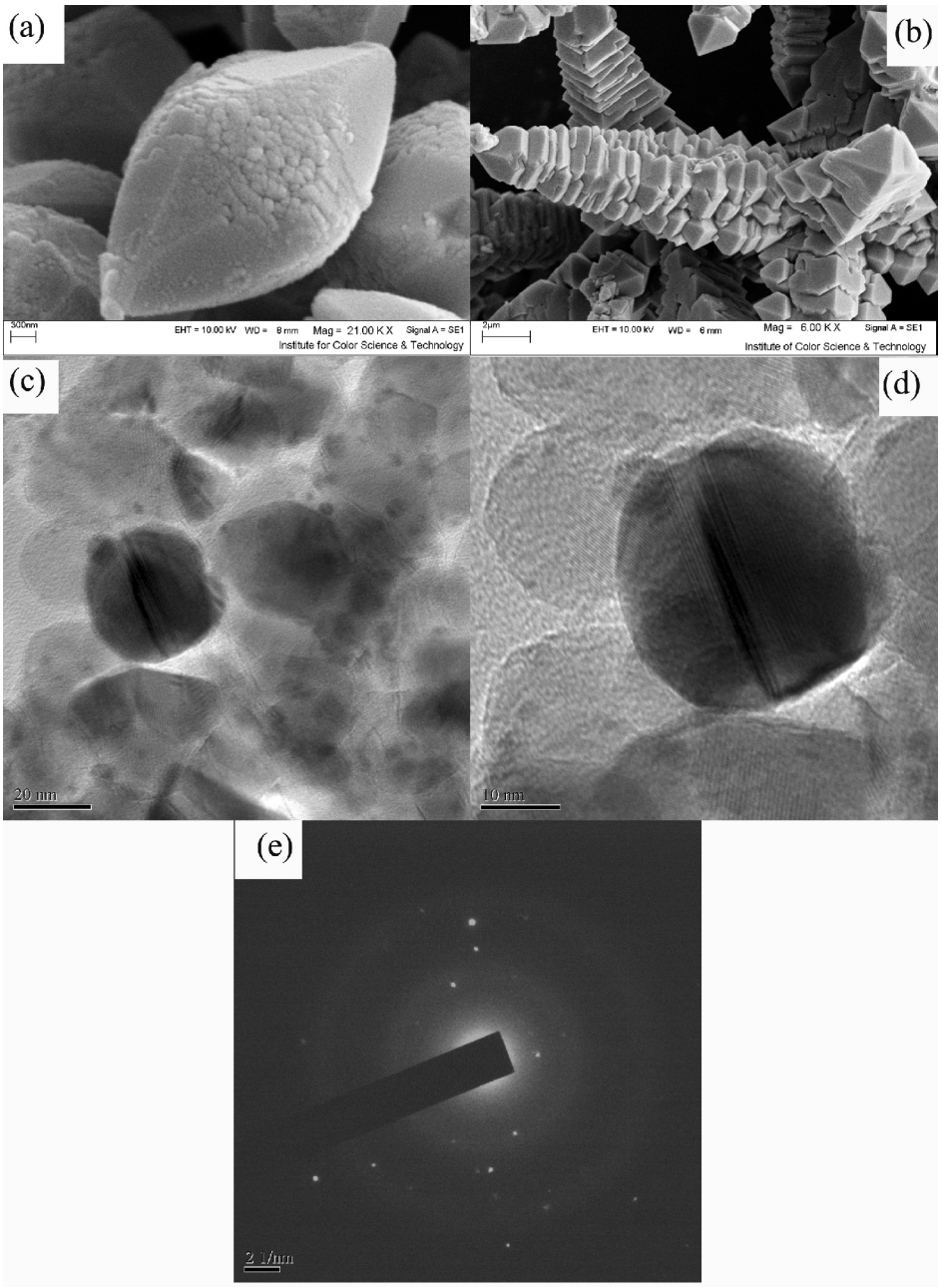
$CdMoO_4$ is an interesting material owning to its excellent optical and chemical properties and electronic structure such as electronic excitation with UV synchrotron radiation, pressure-induced phase transformations and ^{111}Cd and ^{113}Cd spin-lattice relaxation. It is a wide band gap semiconductor (E_g = 3.25 eV), is isostructural to $CaMoO_4$ and $PbMoO_4$ and has a so-called scheelite structure in which the molybdenum atom adopts tetrahedral coordination, where its emission spectrum is mainly attributed to the charge-transfer transitions within the $[MoO_4^{2-}]$ complex. Much effort has been devoted to the synthesis of $CdMoO_4$ with various techniques and methods. The hydrothermal synthesis, sacrificial template route, microwave, microemulsion-mediated route and Ostwald ripening process have been reported to prepare $CdMoO_4$.

Herein, we develop the coprecipitation method to prepare $CdMoO_4$ nanocrystals. The coprecipitation method is a good synthesis process for synthesis of many inorganic powders. This method is simple, convenient and cost effective synthetic procedure and provides an effective way to the synthesis of uniform nanocrystals. In this method, crystallization procedure is performed at low temperature and design of reaction condition is very flexible. Cadmium molybdate ($CdMoO_4$) nanocrystals have been successfully synthesized via coprecipitation method by using $Cd(Sal)_2$ (Sal = salicylidene) and $(NH_4)_6Mo_7O_{24}.4H_2O$ as starting materials in water as solvent. Effects of temperature, reaction time, solvent, surfactant and cadmium source were investigated to reach optimum condition. It was found that particle size, morphology and phase of the final products could be greatly influenced via these parameters. The products were characterized by X-ray diffraction (XRD), Fourier Transform Infrared (FT-IR) spectra, photoluminescence (PL) spectroscopy, energy dispersive X-ray microanalysis (EDX), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The TEM images show $CdMoO_4$ nanocrystals with an average size of 20 nm. The ring-like SAED pattern indicates that the nanocrystals are polycrystalline. Fig. 1 shows SEM images of the samples prepared at 70 ^oC, for 2h with different solvents via coprecipitation method. In the presence of water as solvent, octahedrons are formed.


(a)
300nm
EHT = 10.00 kV WD = 8 mm Mag = 21.00 K X Signal A = SE1
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(b)
2μm
EHT = 10.00 kV WD = 6 mm Mag = 6.00 K X Signal A = SE1
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(c)
20 nm
(d)
10 nm
(e)
2 1/nm

Fig. 1.