

The First Synthesis of $\text{Pb}_{1-x}\text{Mn}_x\text{Se}$ Nanocrystals

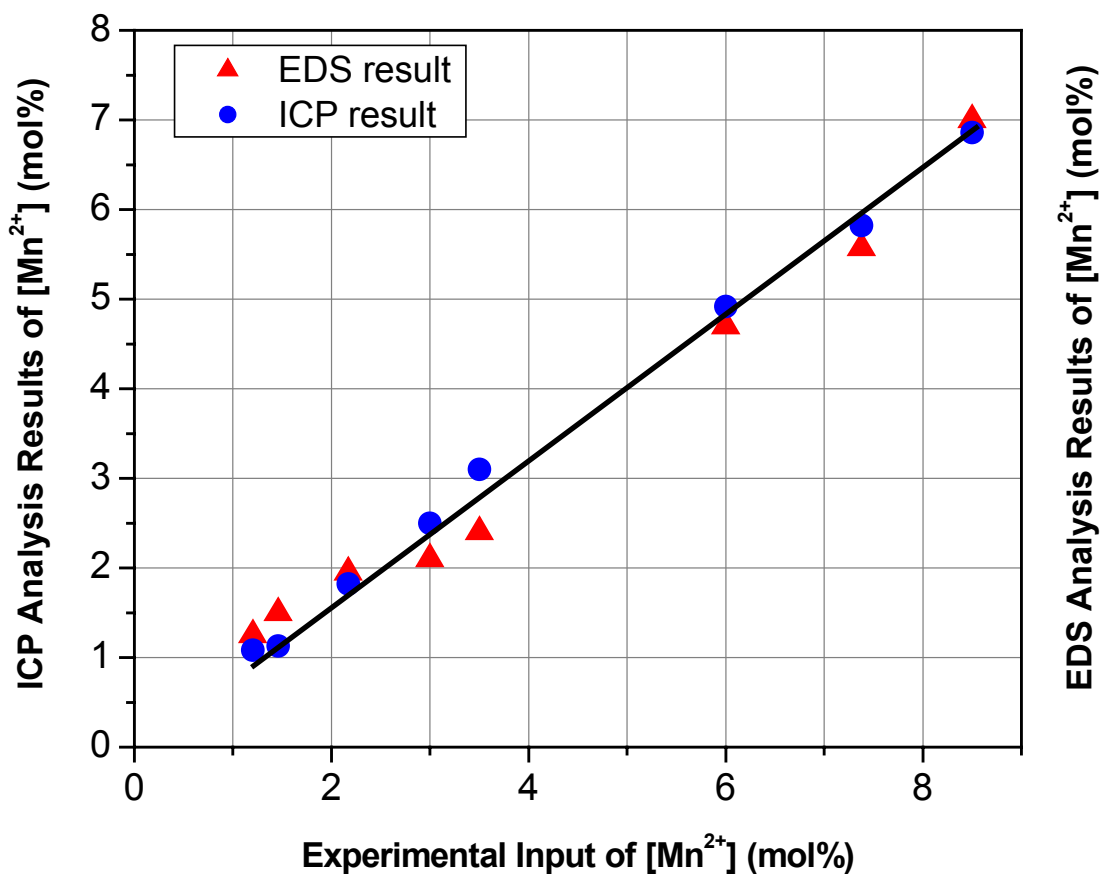
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Supporting Information

Fig. S1

A verification of Mn^{2+} concentration by EDS and ICP analyses. For ICP results, a linear dependence is obviously observed. For EDS results, a linear dependence can be found in high concentration range; for the concentration lower than 3 %, the main deviation may come from measurement error of the weighing device.



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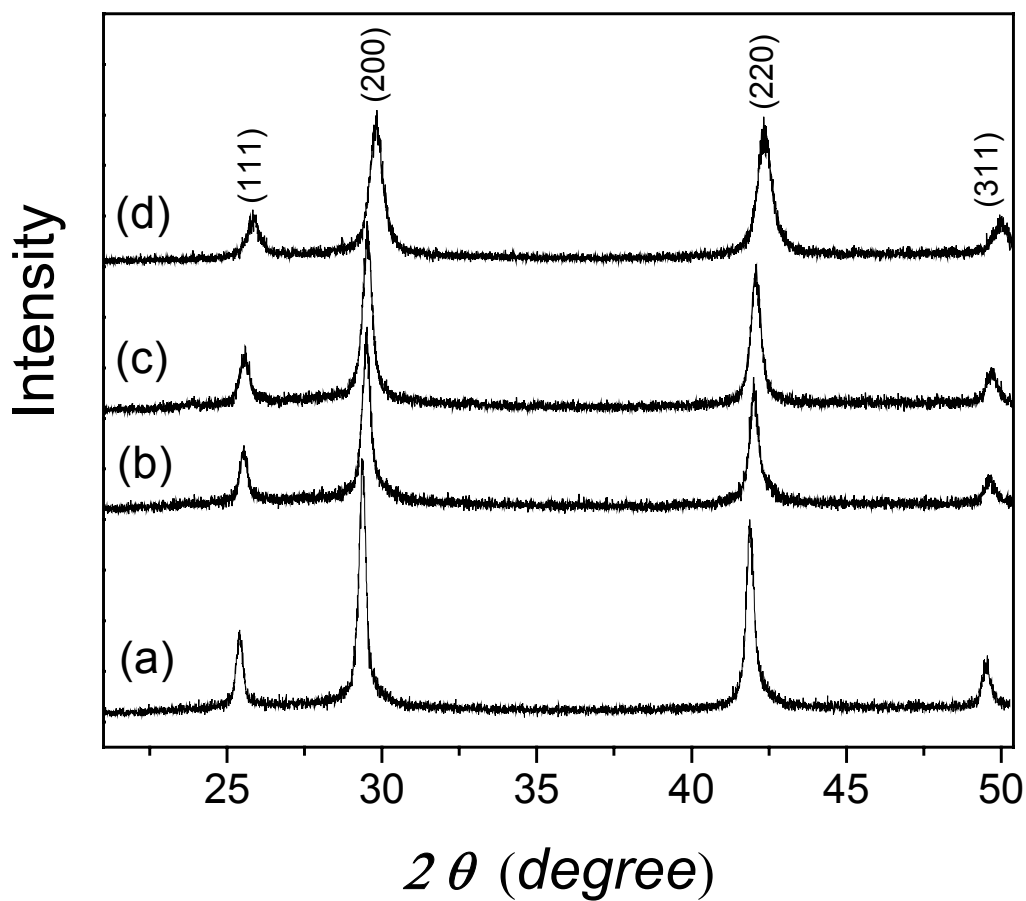
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Fig. S2:

XRD traces of $\text{Pb}_{1-x}\text{Mn}_x\text{Se}$ NCs measured at room temperature: pattern (a) is for pure PbSe NCs (10 nm); (b) for $\text{Pb}_{0.992}\text{Mn}_{0.008}\text{Se}$ NCs; (c) for $\text{Pb}_{0.990}\text{Mn}_{0.010}\text{Se}$ NCs; and (d) for $\text{Pb}_{0.962}\text{Mn}_{0.038}\text{Se}$ NCs.



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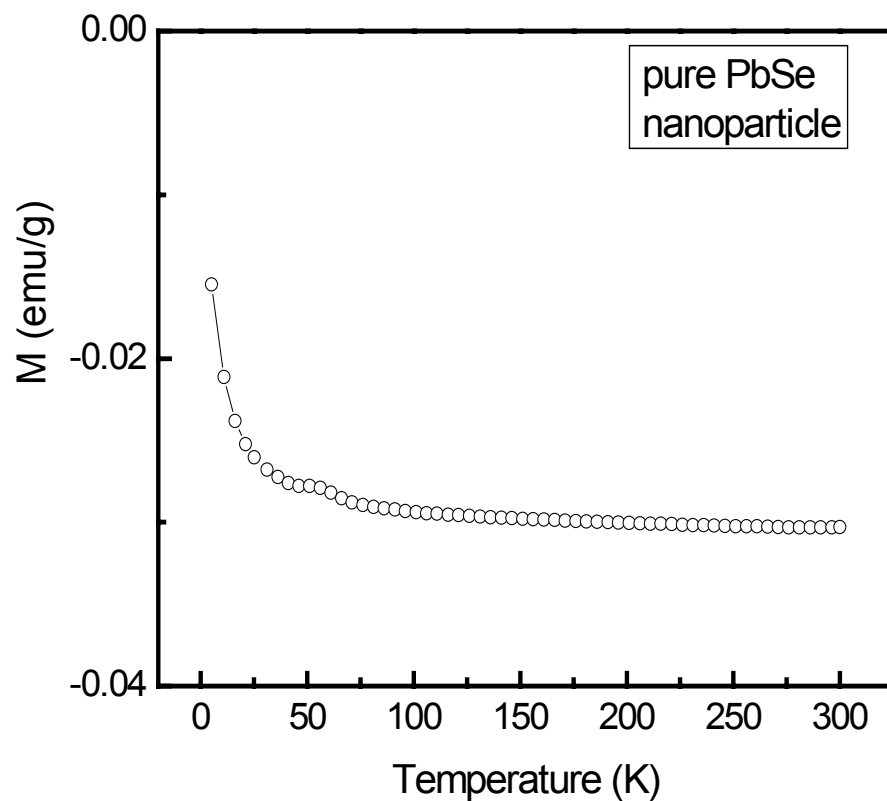
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Fig. S3:

Saturation magnetization of PbSe NCs (10 nm) as function of measuring temperature, indicating the diamagnetic behaviors.



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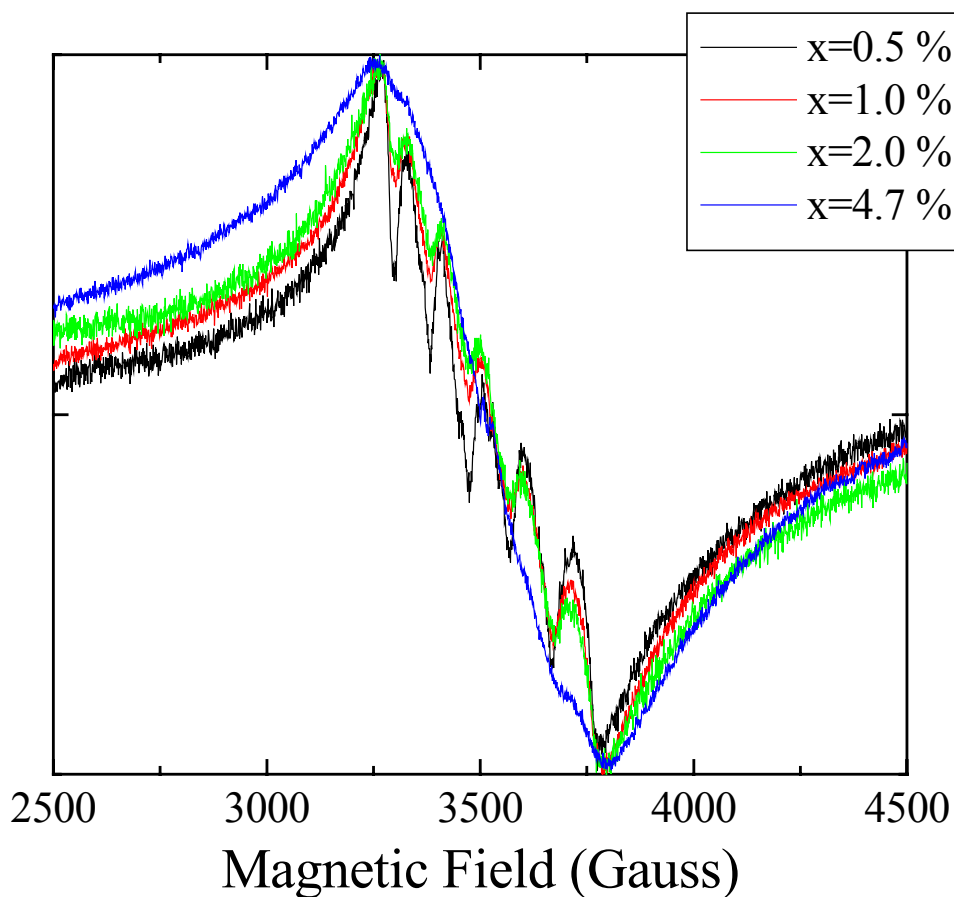
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Fig. S4:

EPR spectra of four $\text{Pb}_{1-x}\text{Mn}_x\text{Se}$ NC samples with different Mn concentration measured at room temperature using the X-band frequency of 9.87 GHz. The intensity of hyperfine splitting decreases when increasing the concentration of Mn ions inside PbSe NCs.



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Note 1: The temperature dependent susceptibility $\chi(T)$ of $\text{Pb}_{1-x}\text{Mn}_x\text{Se}$ NCs was fitted by

$$\chi(T) = \frac{x N_A g^2 s(s+1) \mu_B^2}{3k_B} \frac{1}{(T - T_c)}$$

where x is the fitted result of Mn-concentration, g is the spin-splitting g factor, s is the electron spin of magnetic ion ($s = 5/2$), μ_B is Bohr magneton, N_A is Avogadro's number, and k_B is the Boltzmann constant.

Note 2: The Energy Dispersive Spectroscopy (EDS) was performed using a JSM-5410 scanning electron microscope. For each sample, we used magnifications of "X500", "X1000", "X3500" and "X5000", respectively. For each magnification, at least 5 scans were taken and the composition was calculated based on the average of these measurements. In most cases, different magnifications give similar average composition for a same sample, indicating the distribution of Mn^{2+} is homogenous.

Note 3: The inductively coupled plasma (ICP) analysis was conducted using a VARIAN CCD simultaneous ICP-OES instrument (model: Vista-MPX). Samples were dissolved in a mixture of concentrated HNO_3 and HCl (vol ratio: 1:3), and subsequently boiled for at least 10 mins using a breaker. Such solution was diluted before measurement. Standard Pb^{2+} and Mn^{2+} solutions containing 5% HNO_3 and 1000 $\mu\text{g}/\text{ml}$ of ion were purchased from Alfa Aesar.

Note 4: Lattice parameter (a) of produced nanocrystals was calculated using Cohen's method based on the diffraction peaks of (111), (200) and (220). To correct possible shift of the diffraction angle, standard Si was used to calibrate the apparatus (Philips X-pert system). In order to eliminate interfering $\text{K}_{\text{Cu}} \alpha_2$ peaks, diffraction patterns were also performed " α_2 -strip" treatment using a standard Philips software.