

Synthesis and properties of the $\text{Cs}_2\text{NaIn}_{0.9}\text{Cl}_6:0.1\text{Sb}^{3+}$ nanocrystals

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INTRODUCTION

Halide double perovskites ($\text{A}_2\text{B}^{\text{I}}\text{B}^{\text{III}}\text{X}_6$) (HDPs), sharing a similar crystal structure with a pair of nontoxic heterovalent metal cations replacing two toxic lead cations, are promising alternatives of the CsPbX_3 . Many efforts have been undertaken to prepare high-quality HDPs NCs, including the antisolvent recrystallization and the hot-injection methods [1]. Unfortunately, stabilities of HDP NCs are still inferior to their bulk analogues. That is why, it is necessary to seek effective methods to eliminate these disadvantages.

EXPERIMENT

The first precursor solution was prepared by adding 0.1 mmol Cs_2CO_3 , 1.25 mL of OA, and 3 mL of ODE to a 25 mL 3-neck flask with stirring for 30 min under Ar flow at 120 °C. After dissolving, the temperature was increased to 150 °C to obtain Cs-OA. The second precursor was synthesized by adding 0.05 mmol NaCl (InCl_3) to 2.5 mL ODE with temperature increasing to 120 °C. 0.45 mL of OA and 0.5 mL OAm were added and the temperature was increased to 220 °C. Then, 0.1 mL of the Cs-OA was added and reaction was conducted for 30 min. The solution was cooled down to room temperature. The resulting sample was centrifuged for 4 min and dispersed in 2 mL of toluene.

Optical properties were measured (excitation and emission spectra) using a Hitachi F-4600 fluorescence spectrometer.

RESULTS

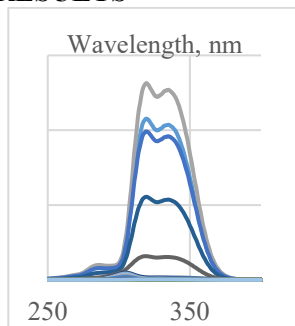


Fig. 1 Excitation spectra of $\text{Cs}_2\text{NaIn}_{0.9}\text{Sb}_{0.1}\text{Cl}_6$ (max λ_{em} = 450 nm)

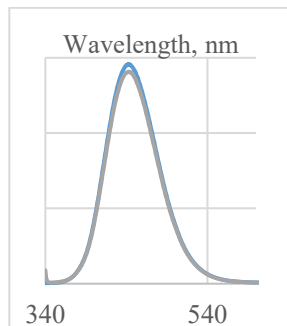


Fig. 2 Emission spectra of $\text{Cs}_2\text{NaIn}_{0.9}\text{Sb}_{0.1}\text{Cl}_6$ (λ_{ex} = 320 nm)



Fig. 3 SEM photo of $\text{Cs}_2\text{NaIn}_{0.9}\text{Sb}_{0.1}\text{Cl}_6$



Fig. 4 $\text{Cs}_2\text{NaIn}_{0.9}\text{Sb}_{0.1}\text{Cl}_6$ under 365 nm

The size of $\text{Cs}_2\text{NaIn}_{0.9}\text{Sb}_{0.1}\text{Cl}_6$ exceeded 100 nm; nevertheless, blue photoemission was observed. The method of synthesis should be improved.

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References

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