Influence of the medium on the optical properties of $CsPbBr_3$ nanocrystals

Skrypnyk T.V., Bespalova I.I., Viagin O.G., Sorokin A.V., Yefimova S.L.

Institute for Scintillation Materials NAS of Ukraine, 61072, 60 Nauky ave., Kharkiv, Ukraine

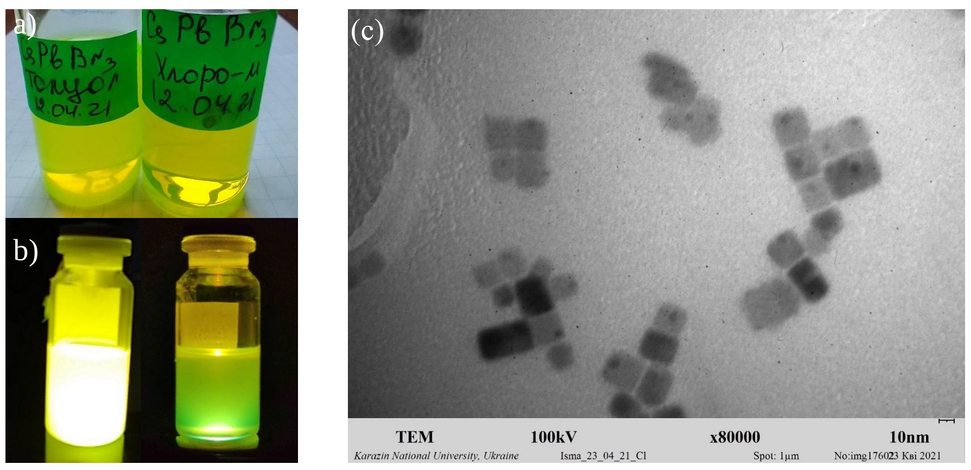
skrypnyk_tamara@isma.kharkov.ua

Introduction

The chemical instability of perovskite materials, which are sensitive to temperature, light, and moisture, limits all technological applications in which the nanocrystals have to be incorporated into a composite or layer. Several chemical methodologies have been reported to improve the stability of lead halide perovskite nanocrystals by combining them with other classes of materials such as different types of polymers, silica, oxide materials, and others.

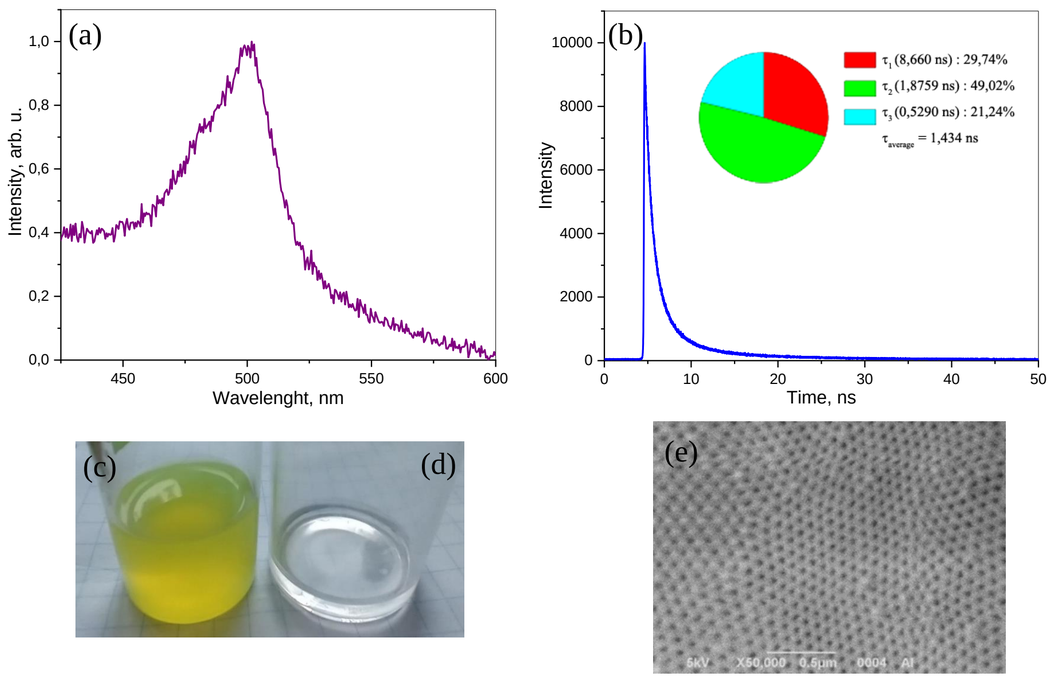
Colloidal solutions of $CsPbBr_3$ in toluene and chloroform

Colloidal solutions of $CsPbBr_3$ in toluene and chloroform (a) in daylight and the same solutions under artificial lighting (b); (c) TEM image of $CsPbBr_3$ NCs.



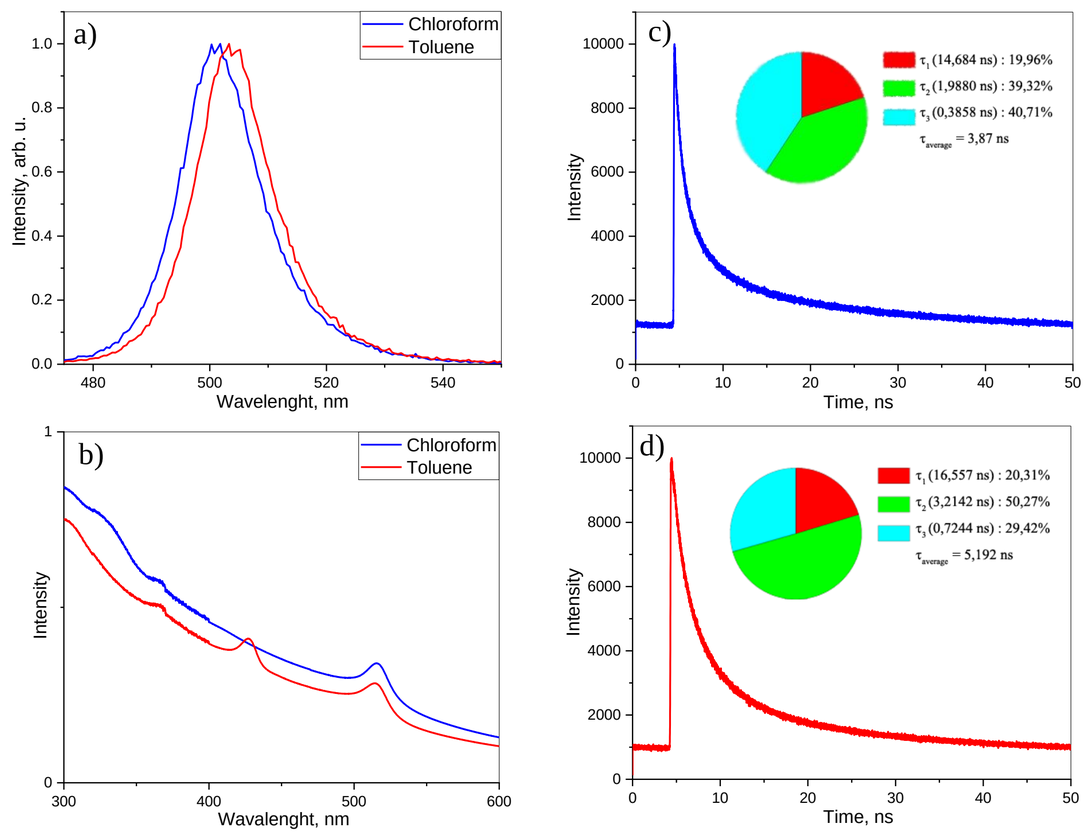
Nanocrystals of $CsPbBr_3$ in AAO (anodic aluminum oxide)

(a) PL spectrum and (b) time-resolved PL decay spectrum for $CsPbBr_3$ NCs in AAO; colloidal solution of $CsPbBr_3$ before (c) and after (d) incorporation in AAO; (e) SEM image of AAO film structure with pores diameter 50nm.



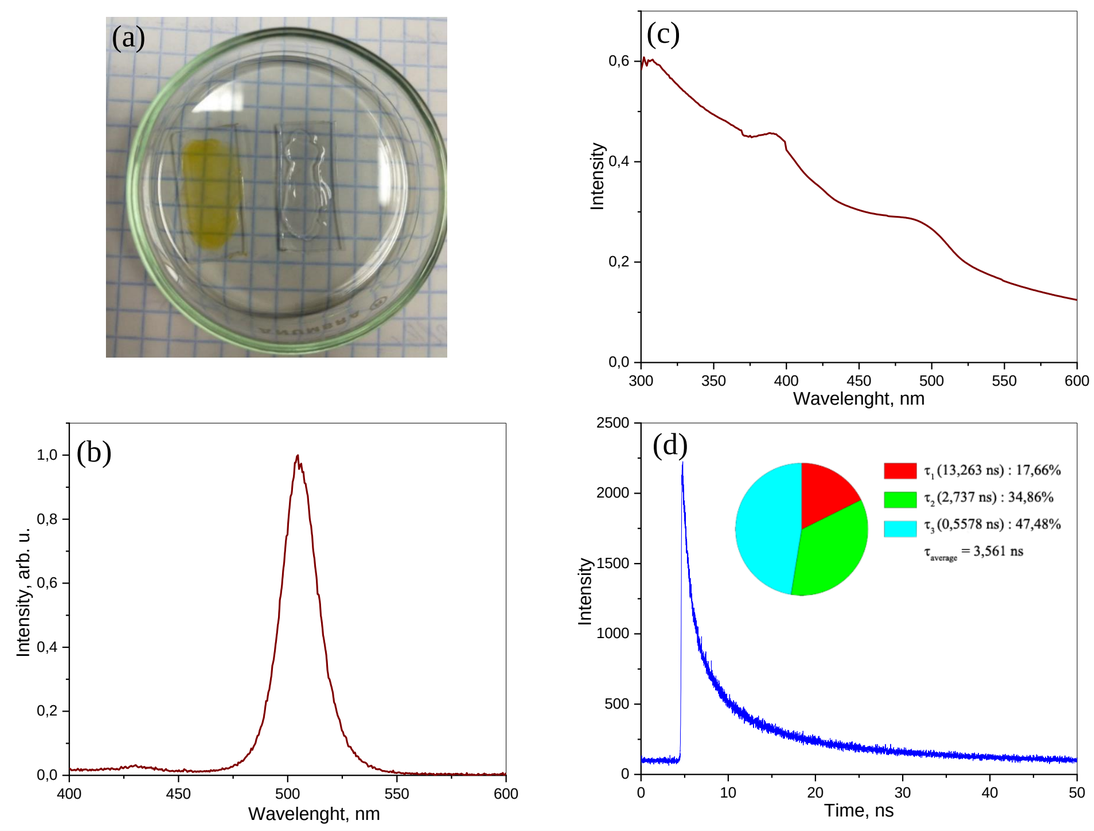
Colloidal solutions of $CsPbBr_3$ in toluene and chloroform

PL spectra (a), absorbance spectra (b), and time-resolved PL decay spectra (c-d) for $CsPbBr_3$ in chloroform and toluene respectively.



Nanocrystals of $CsPbBr_3$ in PMMA (polymethyl methacrylate)

(a) samples of PMMA film with NCs and pure film respectively; (b) PL spectra of NCs $CsPbBr_3$ in PMMA; (c) absorbance spectra for PMMA film and (d) time-resolved PL decay spectrum for $CsPbBr_3$ NCs.



Results

Colloidal nanocrystals of $CsPbBr_3$ perovskite were obtained using the LARP strategy. The creation of solid samples of perovskite nanocrystals by their incorporation into PMMA films and AAO matrices has been carried out. Their optical parameters were determined and compared.

Samples		$\tau_{average}$, ns
A colloidal solution of $CsPbBr_3$	in chloroform	3,870
	in toluene	5,192
Nanocrystals of $CsPbBr_3$ in AAO		1,434
Nanocrystals of $CsPbBr_3$ in PMMA		3,561

References

- L. Protesescu, S. Yakunin, M. I. Bodnarchuk, et al., Nano Lett. 2015, DOI: 10.1021/nl5048779;
- J. Shamsi, A. S. Urban, M. Imran, et al., Chem. Rev., 2019, DOI: 10.1021/acs.chemrev.8b00644;
- O. P. Gujela, V. Gujela, ICRAIE-2016, 2017, DOI: 10.1109/ICRAIE.2016.7939591.