

Cite this: *Chem. Sci.*, 2020, 11, 6923

Correction: Transforming colloidal Cs₄PbBr₆ nanocrystals with poly(maleic anhydride-*alt*-1-octadecene) into stable CsPbBr₃ perovskite emitters through intermediate heterostructures

Dmitry Baranov,^a Gianvito Caputo,^a Luca Goldoni,^b Zhiya Dang,^a Riccardo Scarfiello,^c Luca De Trizio,^a Alberto Portone,^d Filippo Fabbri,^d Andrea Camposeo,^d Dario Pisignano^{bde} and Liberato Manna^{*,a}

DOI: 10.1039/d0sc90125c

rsc.li/chemical-science

Correction for 'Transforming colloidal Cs₄PbBr₆ nanocrystals with poly(maleic anhydride-*alt*-1-octadecene) into stable CsPbBr₃ perovskite emitters through intermediate heterostructures' by Dmitry Baranov *et al.*, *Chem. Sci.*, 2020, 11, 3986–3995, DOI: 10.1039/D0SC00738B.

After the publication of our manuscript, an inquiry from a reader pointed out an earlier publication that was not cited in the context of prior art relevant to our study. We thank the reader for their interest in our work. Prompted by the inquiry, we thought it would be appropriate to acknowledge a few earlier and relevant publications that escaped our attention.

De Matteis *et al.*¹ have reported room temperature excitation–emission maps (photoluminescence maps) of powders containing a mixture of Cs₄PbBr₆ and CsPbBr₃ compounds (Fig. 9 and 10 in ref. 1). The photoluminescence maps show a dip at around ~314 nm in the excitation spectrum of the CsPbBr₃ compound emitting at ~520 nm. The dip matches the wavelength of the electronic absorption in Cs₄PbBr₆. In a similar vein, Shin *et al.*² have reported room temperature photoluminescence maps of CsBr/PbBr₂ co-evaporated thin films containing a mixture of CsPbBr₃ and Cs₄PbBr₆ compounds. In a photoluminescence map shown in Fig. 5b of ref. 2, the emission of the CsPbBr₃ compound at ~517 nm is quenched at the excitation wavelength of ~318 nm, consistent with absorption by Cs₄PbBr₆. Both De Matteis *et al.*¹ and Shin *et al.*² observed an additional room temperature UV emission at ~375 nm and ~360 nm, respectively, from the mixed CsPbBr₃–Cs₄PbBr₆ samples and assigned it to Cs₄PbBr₆.

The room temperature photoluminescence maps of Cs₄PbBr₆–CsPbBr₃ heterostructured nanocrystals studied in our work (Fig. 4a)³ show a qualitatively similar dip in the intensity of ~504 nm emission from CsPbBr₃ when excited at ~314 nm, the absorption wavelength of Cs₄PbBr₆. In contrast to the above-mentioned observations, Cs₄PbBr₆–CsPbBr₃ heterostructured nanocrystals were not emissive in UV at room temperature but showed a weak ~376 nm emission from Cs₄PbBr₆ only when cooled down to ~35 K (Fig. 4b).³ The three studies share similar photoluminescence measurements and chemical formulas of the studied compounds. However, the synthetic origins and structures of the samples, together with discussions of the observed phenomena, are different in the three studies.

Krieg *et al.*⁴ have reported effective colloidal stabilization of CsPbBr₃ nanocrystals over a wide range of concentrations, from 400 mg ml⁻¹ to 4 × 10⁻⁶ mg ml⁻¹ of inorganic content in toluene (Fig. 2 in ref. 4) by means of lecithin, a naturally occurring zwitterionic ligand. The lecithin-stabilized nanocrystals have been reported to be stable against multiple rounds of washing, *i.e.*, precipitation–redispersion with an antisolvent. The poly(maleic anhydride-*alt*-1-octadecene) compound (PMAO) used in our work to transform Cs₄PbBr₆ nanocrystals into CsPbBr₃ nanocrystals yielded colloids of PMAO-capped CsPbBr₃ nanocrystals which survive several rounds of washing and are stable in the concentration range of ~26 mg ml⁻¹ to ~1 × 10⁻⁴ mg ml⁻¹ (Fig. S32). It is notable that both lecithin and PMAO increase the colloidal stability of CsPbBr₃ nanocrystals despite an apparently different surface binding chemistry and a different way of being introduced into the nanocrystal preparation.

The Royal Society of Chemistry apologises for these errors and any consequent inconvenience to authors and readers.

^aNanochemistry Department, Istituto Italiano di Tecnologia, Via Morego 30, 16163 Genova, Italy. E-mail: dmitry.baranov@iit.it; liberato.manna@iit.it

^bAnalytical Chemistry Lab, Istituto Italiano di Tecnologia, Via Morego 30, 16163 Genova, Italy

^cCNR NANOTEC, Institute of Nanotechnology, c/o Campus Ecotecnico, via Monteroni, 73100 Lecce, Italy

^dNEST, Istituto Nanoscienze-CNR, Piazza S. Silvestro 12, I-56127 Pisa, Italy

^eDipartimento di Fisica "Enrico Fermi", Università di Pisa, Largo Bruno Pontecorvo 3, I-56127 Pisa, Italy



References

- 1 F. De Matteis, F. Vitale, S. Privitera, E. Ciotta, R. Pizzoferrato, A. Generosi, B. Paci, L. Di Mario, J. S. Pelli Cresi and F. Martelli, Optical Characterization of Cesium Lead Bromide Perovskites, *Crystals*, 2019, **9**(6), 280.
- 2 M. Shin, S.-W. Nam, A. Sadhanala, R. Shivanna, M. Anaya, A. Jiménez-Solano, H. Yoon, S. Jeon, S. D. Stranks, R. L. Z. Hoyer and B. Shin, Understanding the Origin of Ultrasharp Sub-bandgap Luminescence from Zero-Dimensional Inorganic Perovskite Cs₄PbBr₆, *ACS Appl. Energy Mater.*, 2020, **3**(1), 192–199.
- 3 D. Baranov, G. Caputo, L. Goldoni, Z. Dang, R. Scarfiello, L. De Trizio, A. Portone, F. Fabbri, A. Camposeo, D. Pisignano and L. Manna, Transforming colloidal Cs₄PbBr₆ nanocrystals with poly(maleic anhydride-alt-1-octadecene) into stable CsPbBr₃ perovskite emitters through intermediate heterostructures, *Chem. Sci.*, 2020, **11**(15), 3986–3995.
- 4 F. Krieg, Q. K. Ong, M. Burian, G. Raino, D. Naumenko, H. Amenitsch, A. Suess, M. J. Grotevent, F. Krumeich, M. I. Bodnarchuk, I. Shorubalko, F. Stellacci and M. V. Kovalenko, Stable Ultraconcentrated and Ultradilute Colloids of CsPbX₃ (X = Cl, Br) Nanocrystals Using Natural Lecithin as a Capping Ligand, *J. Am. Chem. Soc.*, 2019, **141**(50), 19839–19849.

