

Using Low Temperature Photoluminescence Spectroscopy to Investigate $\text{CH}_3\text{NH}_3\text{PbI}_3$ Hybrid Perovskite Degradation

Khaoula Jemli^{1,2}, Hiba Diab¹, Ferdinand Lédée^{1,2}, Gaëlle Trippé-Allard¹, Damien Garrot³, Bernard Geffroy⁴, Jean-Sébastien Lauret¹, Pierre Audebert², Emmanuelle Deleporte¹

¹Laboratoire Aimé Cotton, ENS Cachan, CNRS, Université Paris-Sud, Université Paris-Saclay, 91405 Orsay, France; ²PPSM, ENS Cachan, Université Paris-Saclay, 94235 Cachan, France ³GEMaC, CNRS, Université de Versailles Saint-Quentin-en-Yvelines,

Université Paris-Saclay, 78000 Versailles, France ⁴LICSEN, NIMBE, CEA, CNRS, Université Paris-Saclay, 91190 Gif-sur-Yvette, France; gaelle.allard@u-psud.fr

Investigating the stability and evaluating the quality of the $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite structures is quite critical both to the design and fabrication of high-performance perovskite devices [1] and to fundamental studies of the photophysics of the excitons. In particular, it is known that, under ambient conditions, $\text{CH}_3\text{NH}_3\text{PbI}_3$ degrades producing some PbI_2 [2]. We show here that low temperature photoluminescence (PL) spectroscopy is a powerful tool to detect PbI_2 traces in hybrid perovskite layers and single crystals [3]. Because PL spectroscopy is a signal detection method on a black background, small PbI_2 traces can be detected, when other methods currently used at room temperature fail. Our study highlights the extremely high stability of the single crystals compared to the thin layers. Defects and grain boundaries are then thought to play an important role in the degradation mechanism.

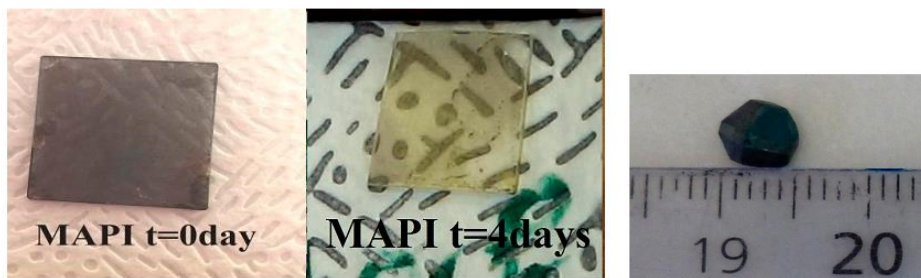


Figure 1 Photography of a 800 nm thick $\text{CH}_3\text{NH}_3\text{PbI}_3$ layer deposited by spin-coating on a quartz substrate, just after the deposition (left) and 4 days after the deposition (middle). (Right) Photography of a millimeter sized MAPI crystal, 6 months after its growth.

References

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[2] J. Yang, B.D. Siempelkamp, D. Liu, T.L. Kelly, *ACS Nano* (2015), 9, 1955-1963.

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