Optimizing single crystal-perovskite sizes, shapes, and their roles on electroluminescence blinking

([1]*Graduate School of Environmental Science, Hokkaido University*, [2]*Reasearch Institute for Electronic Science, Hokkaido University*) Dong Zhang,[1] Takuya Okamoto,[2] Vasudevanpillai Biju[1,2]

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Photoluminescence (PL) and electroluminescence (EL) blinking are common phenomena in nano-size semiconductors, which negatively impact the properties and optical/photovoltaic applications of these materials. Blinking is the random fluctuations of the PL or EL intensity. The intensity levels during the fluctuation switch between the ON, Grey, and OFF states.[1]

In this study, two types of $MAPbBr_3$ microcrystals (MCs) are synthesized by the Inverse Temperature Crystallization (ITC) and Room Temperature Crystallization (RTC) methods. We demonstrate that the crystal size and EL properties vary considerably with the synthesis method. The PL spectra show the single crystals prepared by the RTC method have a bright narrow emission peak at 534 nm (Figure 2c). The optical properties of these MCs are measured by the time-resolved fluorescence microscopy. We find that the single crystal prepared by the RTC method has a short PL lifetime (τ_1=1.23 ns, τ_2=1.32 ns; Figure 2d). The EL blinking is measured by sandwiching $MAPbBr_3$ MCs between two ITO electrodes. The crystals prepared by the RTC method show bright EL with blinking. This can be explained by the charging-discharging or trapping-de-trapping processes. Additionally, the suppression of blinking is investigated by halide vacancy filling.

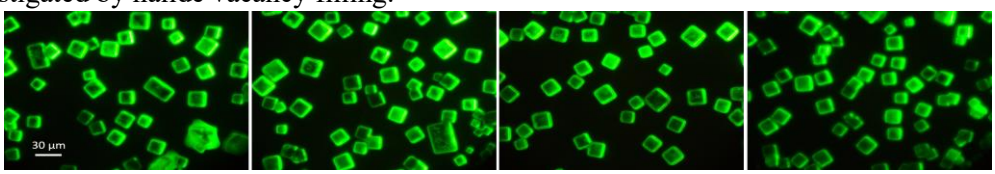

Figure 1. PL images of $MAPbBr_3$ MCs.

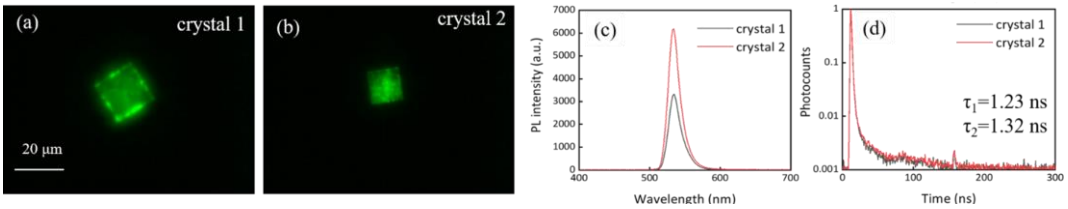

Figure 2. (a,b) PL images, (c) PL spectra, and (d) PL decay profiles of $MAPbBr_3$ MCs.

1) Y. Tian, A. Merdasa, M. Peter, M. Abdellah, K. Zheng, C. S. Ponseca, Jr., T. Pullerits, A. Yartsev, V. Sundstrom and I. G. Scheblykin, *Nano Lett*. **2015**, 15, 1603-1608.