Preparation and optically pumped lasing of single-crystal $CH_3NH_3PbCl_xBr_yI_z$ perovskites

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In this study, we investigate emission properties of $CH_3NH_3PbCl_xBr_yI_z$ (x+y+z = 3) fabricated by cast-capping method. Back to previous studies from other researchers, there are 2 ways to synthesized crystal perovskites thin films[1]: solution process based on spin coating and thermal vapor deposition. Because of some drawback maintained in both methods, recently we successfully fabricated large-sized single-domain $CH_3NH_3PbBr_3$ crystals and observed edge-emitting Fabry-Pérot lasing with very low threshold, and high Q factor[2]. Furthermore, vertical-cavity surface-emitting lasing was also observed in the $CH_3NH_3PbBr_3$ crystal sandwiched between DBR mirrors. On the other side, Xing et al. showed wide wavelength tunability in amplified spontaneous emission wavelengths at room temperature using perovskite films prepared by spin coating method[3]. Shi et al. showed low trap density and long carrier diffusion in single-crystal perovskites[4]. Another study, Kim et al. indicated that the quality of planar perovskite layers (homogeneous, flat surface and a pinhole-free perovskite layer) was important for optical devices performance[5]. From these points of view, here we adopt the cast-capping method to prepare single-crystals of $CH_3NH_3PbCl_xBr_yI_z$ by mixing different halide perovskites in the precursor solution. Figure 1 shows fluorescence micrographs of $CH_3NH_3PbBrI_2$ and $CH_3NH_3PbClBr_2$ indicating different emission colors. In the presentation, their optically pumped lasing performances are compared with that of $CH_3NH_3PbBr_3$ crystal.

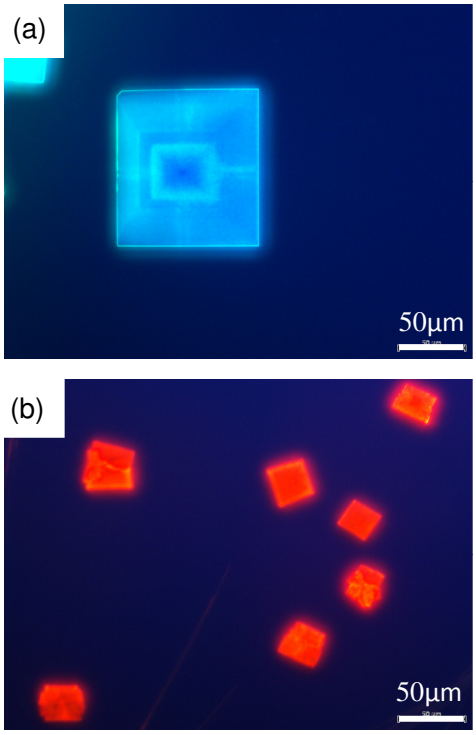

Figure 1 Fluorescence micrographs of single-crystal $CH_3NH_3PbClBr_2$ (a) and $CH_3NH_3PbBrI_2$ (b).

References

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