ペロブスカイトヘテロ構造中のハロゲンイオン相互拡散の部分的抑制

Partial suppression of halide ion interdiffusion in the perovskite heterostructures

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Metal halide perovskites have gathered great attention due to their potential applications in optoelectronics. To enhance the performances of perovskite devices, we have focused on the epitaxial growth of all perovskite single-crystalline heterostructures by vacuum evaporation. By coevaporation of PbI_2 and CH_3NH_3I we only obtained Br-rich $CH_3NH_3Pb(BrI)_3$ alloy epitaxial thin films on $CH_3NH_3PbBr_3$ single crystals due to interdiffusion of halide ions [1]. To suppress the diffusion, we have changed the halide anions to Cl^-, and have successfully grown $CH_3NH_3PbI_3$ epitaxial thin films on $CH_3NH_3PbCl_3$ single crystals including a Cl-rich alloy layer [2]. In addition, the epitaxial growth of $CH(NH_2)_2PbI_3$ on $CH_3NH_3Pb(BrCl)_3$ alloy substrates were achieved in solution method without the interdiffusion [3]. Here we report the partial suppression of ion interdiffusion by changing the A site organic cations.

We grew a $CH(NH_2)_2PbI_3$ thin film on a single crystalline $CH_3NH_3PbBr_3$ substrate by coevaporation of PbI_2 and $CH(NH_2)_2I$. We characterized the sample by using X-ray diffraction (XRD) and photoluminescence (Fig. 1 and 2). We found that the sample has a structure of I-rich mixture of α–$CH(NH_2)_2PbI_3$ and $CH_3NH_3PbBr_3$ on the $CH_3NH_3PbBr_3$ substrate. This indicates the partial suppression of the interdiffusion by changing the organic cations. The mixture is probably caused by the exchange of both halide and organic ions. The interdiffusion continued after the growth, which is a clear contrast to Chen's work [3]. The epitaxial nature of the obtained thin film will be discussed in the presentation.

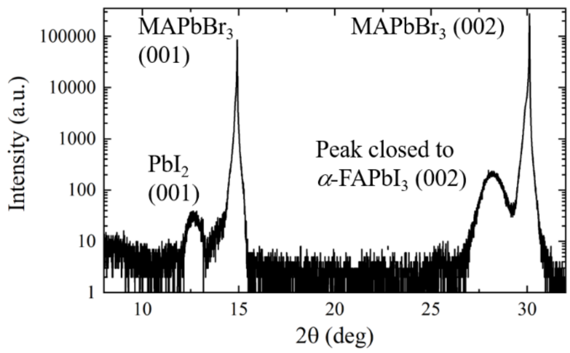

Fig. 1 $2\theta/\omega$ pattern of the sample

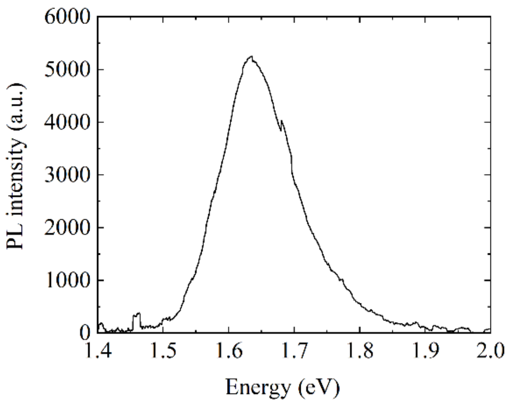

Fig. 2 Photoluminescence spectrum of the sample

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[2] Z. Liu, T. Matsushita and T. Kondo, Solid State devices and Materials 2020, F-6-02.

[3] Y. Chen *et al.*, *Nature* **577** (2020) 209.