THz-wave absorption property in $MAPbBr_3$ thin film on flexible substrate formed by sequential vacuum evaporation method

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1. Introduction

Recently, a lot of research has been actively conducted on organohalide hybrid perovskite (OHP) because of several physical properties such as wide bandgap, low exciton binding energy, and high carrier mobility. Current studies are focused on the possible applications such as solar-cell, optoelectronic, memory, and sensor devices. Our previous reports [1] on the significant THz-wave absorption properties in defect-incorporated $CH_3NH_3PbI_3$ ($MAPbI_3$) and $CH(NH_2)_2PbI_3$ ($FAPbI_3$) also showed a possibility of novel applications such as THz-wave modulating and sensing devices. In this study, continuously, we have fabricated and characterized $MAPbBr_3$ thin film to understand its THz-wave property.

2. Experimental method

The $MAPbBr_3$ thin films were formed by the sequential vacuum evaporation (SVE) method. Firstly, $PbBr_2$ layer (100 nm) was evaporated with the deposition rate of 10 Å/s on Si, glass, and PET (Polyethylene terephthalate) substrates. Sequentially, MABr layer (300 nm) was evaporated with the deposition rate of 2.0 Å/s. Finally, the formed films were performed by post-annealing at 110 °C for 10 min and spin-casting with 5 mg/4 ml of PTAA ([poly[bis(4-phenyl)(2,4,6-trimethylphenyl)amine]])/chlorobenzene solution at 4 krpm, respectively. All samples were characterized by XRD, XPS, UV-Vis, SEM, and THz-TDS.

3. Results and discussion

The cross-sectional view feature in SEM shows that the thickness of the $MAPbBr_3$ thin film is approximately observed with 300 nm (Fig. 1). In the case of PTAA layer, it is observed with 5 nm. Interestingly, three significant THz-wave absorption peaks at 0.8, 1.4, and 2.0 THz are observed (Fig. 2). In this talk, we will discuss about the origin of THz-wave absorption in the $MAPbBr_3$ thin film.

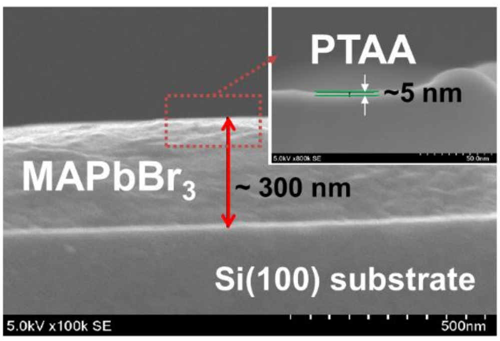

Figure 1. Cross section morphologies of PTAA/$MAPbBr_3$ using SEM

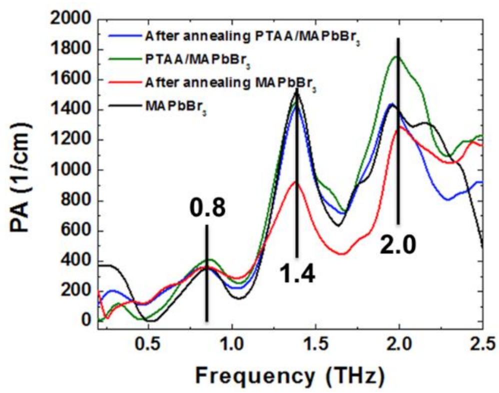

Figure 2. THz-TDS measurements of PTAA/$MAPbBr_3$ and $MAPbBr_3$ before and after annealing

[1] S. Kobori, Y. Nakamoto, M.-C. Jung, *et al.* The 65th JSAP Spring Meeting (2018.3.17) 17p-P6-20.