Initial growth observation of PbI$_2$ and MAPbI$_3$ thin films grown by infrared laser MBE
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Abstract

With the fast development of organometallic halide perovskite solar cells (PSCs) due to their promising high-efficiency with low-cost photovoltaic technology [1], it becomes necessary to investigate further optimization of their fabrication methods. A significant efficiency improvement of the fabrication methods which are classified into two processing methods 1-step and 2-step was achieved by different research groups such as morphology controlling by addition of small amount of additive N-cyclohexyl-2-pyrrolidone (CHP), NH$_4$Cl and 1, 8-Diodooctane (DIO) [2, 3]. The reaction mechanism between PbI$_2$ and MAI were discussed in several research work such as conversion of PbI$_2$ to MAPbI$_3$ through layered intermediates or sandwich form [4]. However, the lack of clear evidence about the conversion mechanism from PbI$_2$ to MAPbI$_3$ make the optimization of the process quite difficult. Therefore, the investigation of the initial growth of PbI$_2$ thin films before and after conversion to MAPbI$_3$ thin films is important in the determination and improvement of MAPbI$_3$ thin films quality. In this study, we used a combinatorial approach using a infrared laser MBE system [5] with combined with thickness-gradient fabricated using a moving mask from an edge to other edge of the substrate. These technique enable us to fabricate a MAPbI$_3$ thin films library of initial growth in the range from zero to several monolayers.

References