Development of Novel Synthetic Methods for Hybrid Perovskites Using Reactive Polyiodide Melt CH3NH3I-I2

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At the moment, renewable solar energetics is instantly developing. Among all types of photovoltaic (PV) devices perovskite solar cells demonstrate high efficiency and low cost comparing to the most well-known silicon PV cells and other thin-film solar cells. Recently, a new approach for the room-temperature MAPbI3 perovskite crystallization by using novel highly-reactive polyiodide melts (RPMs) has been developed. RPMs are based on the molecular iodine and methylammonium iodide (MAI) and can be easily prepared by mixing MAI with I2 at room temperature. MAI-I2 RPMs show extremely high reactivity and allow to obtain perovskite in just a few seconds at room temperature by metallic lead conversion. This melt gives new opportunities for the development of more simple and effective methods for the preparation of high-quality perovskite thin films with large grain size. The objectives of current project were to investigate RPM's fundamental properties (solubility of metallic lead in MAI-I2), develop novel thin-film preparation methods of hybrid perovskite via metallic lead conversion by RPMs in a confined space, develop thin-film preparation method of mixed anion perovskite via mixed anion MAI/MABr-I2 melts by spray technology, and prepare perovskite solar cells based on RPMs technology. According to obtained results lead solubility in MAI-I2 at room temperature equals to 0.5-1 mass %. Lead conversion in confined space allows to prepare dense large-grain perovskite films with different relief depending on applied stamp. The possibility to obtain mixed-anion MAPb(BrxI1-x)3 perovskite by using mixed RPMs MAI/MABr-I2 has been shown. Finally, solar cells with FTO/TiO2/perovskite/spiro-OMeTAD/Au architecture were prepared by using developed during this project technologies.

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