

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(BrxI_{1-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.