助成対象研究の紹介文

Development of Tin-based halide semiconductor materials for high efficiency photovoltaic device

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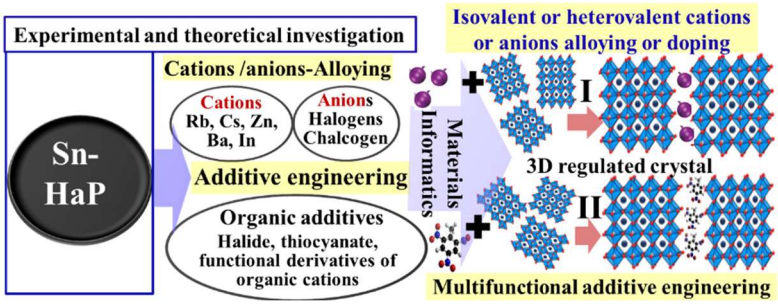
Lead halide perovskite (Pb-HaP) based solar cells have demonstrated promising high efficiency for low-cost photovoltaic technology. But the toxicity of Pb in Pb-HaP and poor device stability are two issues to be resolved for its practical application. Multiple approaches have been attempted to transfer the Pb-HaPSCs technology to Pb-free materials but the progress in device performance is not so exciting. The primary reasons for low device efficiency are the fundamental differences in film growth, optoelectronic quality, and multiple structural dimensionalities. In the case of Sn-HaP, though it was considered as one of the promising alternatives in terms of optoelectronic properties, high-quality film growth is challenging due to severe oxidation and poor film morphology



In this proposal, we fabricate a highly efficient Pb-free HaP-based device by optimizing the optoelectronic quality of Sn-HaP thin film (morphology and optoelectronic properties) adopting additive engineering and structural regulation adopting approach shown in the schematic diagram. We will develop highly efficient devices by interface engineering for optimal band alignment and lattice mismatch at the interface. We believe that the successful completion of the proposed work will pave a way to solve the toxicity and device instability issues of Pb-HaP based photovoltaic device.

【実用化が期待される分野】

Highly efficient, low-cost, and non-toxic PV technology is indispensable for the realization of a sustainable low carbon society. The Sn-HaP-based solar cells are the best candidate for eco-environment friendly PV technology. The Sn-HaP based PV device can be used for indoor PV applications. It can be used as a Pb-free HaP top cell for the development of a high-efficiency Si/Sn-HaP tandem device. It can be used as a photodiode, scintillator, and many IoT devices.