

ペロブスカイト太陽電池の高効率化シミュレーション

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Device Simulation of High Efficiency Perovskite Solar Cells (¹*Ritsumeikan University*)

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Organic-inorganic hybrid perovskite solar cells are gathering significant attention as a promising candidate for low-cost and high-efficiency printable solar cells. In this presentation, we discuss the operation and design of high-efficiency perovskite solar cells utilizing a Solar Cell Capacitance Simulator (SCAPS) - a widely used one-dimensional device simulator in conventional inorganic thin-film solar cells. Key focus areas include film thickness, work function of the rear electrode, the optimal relative position of energy bands (electron transport layer, hole transport layer and perovskite layer), and the impact of band grading in perovskite. This study aims to provide insights into device optimization strategies for enhancing the performance of perovskite solar cells.

Keywords : Perovskite, Solar cells, Device simulation, Optimum design

有機無機ハイブリッドペロブスカイト太陽電池は高効率かつ低コストなプリンタブル太陽電池として期待されている。本講演では、従来無機薄膜太陽電池で広く利用されてきた1次元デバイスシミュレータである Solar Cell Capacitance Simulator (SCAPS)を用いたペロブスカイト太陽電池の動作と高効率化デバイス設計、特に膜厚、裏面電極の仕事関数、エネルギーバンド（電子輸送層、正孔輸送層、ペロブスカイト層）の相対的な最適位置関係、バンドグレーディングの効果などについて議論する。

- 1) Device modeling of perovskite solar cells based on structural similarity with thin film inorganic semiconductor solar cells, T. Minemoto, M. Murata, *J. Appl. Phys.* **2014**, *116*, 054505.
- 2) Theoretical analysis on effect of band offsets in perovskite solar cells, T. Minemoto, M. Murata, *Sol. Energy Mater. Sol. Cells* **2015**, *133*, 8.
- 3) Theoretical analysis of back junction band alignment in Sn-Ge perovskite solar cells with inverted p-i-n structure, T. Minemoto, Y. Kawano, T. Nishimura, Q. Shen, K. Yoshino, S. Iikubo, S. Hayase, J. Chantana, *Sol. Energy Mater. Sol. Cells* **2020**, *206*, 110268.