

Energy Conversion and Energy Storage

R&D Project Title:

High-Efficiency Ratchet-Intermediate Band Solar Cell Film

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Summary :

High-efficiency, low-cost solar cell film will be developed based on the concept of ratchet-type intermediate band solar cell (IBSC) integrated with light trapping structure.

We take advantage of long carrier lifetimes observed in rare-earth ion luminescence centers in Erbium-doped GaAs and aim to maximize the two-step photon absorption (TSPA) rate from the ratchet band to conduction band thereby increasing the net photocurrent and hence efficiency.

For the fabrication of high-efficiency solar cell film as a final goal of the project, epitaxial lift-off (ELO) technique with high reliability and reproducibility will be developed together with optimum light trapping structure.

If the photovoltaic power production continues to increase, the emission of CO₂ is expected to be reduced by 94 Mton-CO₂/year by 2050 (in Japan), and new-generation high-efficiency solar cell technology could contribute to 1/3. On the other, light-weight and bendable solar cell film is also expected to be widely used in mobility applications including solar EVs and 5.9 Mton-CO₂/year emission reduction can be expected by 2050.

