

Hysteresis-free highly efficient innovative perovskite hybrid solar cells

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Since Grätzel et al reported efficiency dye-sensitized solar cells, significant effort has been focused on developing cost-effective solar cells because of their unique device architecture of n-i-p. The sensitized solar cells separate the generated electrons and holes by prompt injection into electron conductor and hole conductor so that the separated charge carriers are not easily recombined with each other. However, they have been in trouble to enhance the device efficiency and eliminate liquid type electrolyte for a long time. Recently, inorganic semiconductors, quantum dots, and perovskite hybrid sensitizer have been developed to replace conventional Ru/organic dye and new sensitizers are considered as promising candidates having great potential to make breakthrough in sensitized solar cells due to adopt the advantage of inorganic materials. Since Kojima et al reported organic-inorganic hybrid perovskite new sensitizer, dramatic increase of device efficiency has been achieving and currently the record efficiency reaches over 20 %. However, the perovskite solar cells often exhibit significant J-V (current density-voltage) hysteresis with respect to the scan direction and scan rate. The origin of J-V hysteresis is still under debate: ferroelectricity, ionic conducting, or traps. Here I would like to suggest the origin of J-V hysteresis in perovskite solar cells is related to the unbalanced electron flux and hole flux so that the unbalanced electrons and holes are recombined at trap sites with delay time by trapping/detrapping process.