

Transfer of nanoporous electrodes for the completely TCO-free and flexible dye-sensitized solar cells

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For the commercialization and wide application of dye-sensitized solar cells (DSSCs), the cost effectiveness is much more important than the absolute efficiency itself. Given that consideration, elimination of expensive transparent conducting oxides (TCO) and replacement of conventional glass substrates with flexible plastic substrates could be a viable strategy to realize extremely low cost DSSCs. Toward this end, for the first time, we report a completely TCO-free and flexible DSSC fabricated on a plastic substrate by using a unique transfer technique. The working and counter electrodes were fabricated by perfectly transferring high-temperature-annealed nanoporous TiO₂ and Pt/carbon films, respectively, onto a flexible plastic substrate without any exfoliation. The conventional TCO layer was replaced by depositing an economically advantageous TiN back contact layer on the nanoporous TiO₂ electrode. The fabricated working electrode assembled with the conventional counter electrode exhibited a new record efficiency of 8.10% for flexible DSSCs, in spite of the TCO-free structure. In addition, the fabricated completely TCO-free and flexible DSSC exhibited a remarkable efficiency of 7.27%.