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Performance improvement of dye-sensitized solar cell by introducing Sm^{3+}/Y^{3+} co-doped TiO_2 film as an efficient blocking layer

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ABSTRACT:

Luminescence mediums: samarium ion and yttrium ion, were introduced to expand the photo-response region of TiO_2 by means of the down-conversion effect to convert ultraviolet light into visible light, offering a unique method to enhance the photovoltaic performance of dye-sensitized solar cells (DSSCs). Their crystal structures, optical properties as well as photovoltaic performance were investigated systematically. The result indicates that the DSSCs doped with a total molar ratio of 4 mol% of Sm^{3+} and Y^{3+} show an overall power conversion efficiency of 4.09%, which is equivalent to improvements of 17.52% and 16.2% as compared to the no blocking layer DSSCs and pure TiO_2 blocking layer DSSCs respectively. The improvement in conversion efficiency is attributed to the dual effects including down-conversion of ultraviolet light and reduction of electron-hole recombination rate.

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