

Enhanced light conversion efficiency of dye-sensitized solar cells by utilization of high luminous CeO₂:Er/Yb upconversion phosphor

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Upconversion phosphor (UCP) converts the near-infrared (NIR) light to the visible light and has been used to improve the light-harvesting efficiency of solar cells. The emission color and intensity of UCPs strongly depend on the type and concentration of activators, the host composition, and the preparation methods. In this work, CeO₂:Er³⁺,Yb³⁺ upconversion phosphor particles were prepared by spray pyrolysis and the luminescent properties were improved by introducing organic additives to the spray solution. As a result, dimethylformamide addition was found to largely enhance the emission intensity of CeO₂:Er³⁺,Yb³⁺ upconversion phosphor. The synthesized phosphor was applied to the photoanode of dye-sensitized solar cell (DSSC). The efficiency of 9.08 % was achieved by dispersing the optimized phosphor particles to the titania layer, which was about 20% improved compared to the cell without the phosphor.