Photovoltaic efficiency enhancement of polycrystalline silicon solar cells by a highly stable luminescent film.

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Streszczenie

Si-based solar cells have dominated the entire photovoltaic market, but remain suffering from low power conversion efficiency (PCE), partly because of the poor utilization of ultraviolet (UV) light. Europium(III) (Eu^{3+}) complexes with organic ligands are capable of converting UV light into strong visible light, which makes them ideal light converter to increase the efficiency of solar cells. However, the low stability of such complexes seriously hampers their practical applications. In this work, we report a highly stable and luminescent ethylene-vinyl acetate (EVA) copolymer film consisting of a Eu^{3+} complex as a down-shift material, Eu $(ND)_4CTAC$ (ND = 4-hydroxy-2-methyl-1,5-naphthyridine-3-carbonitrile, CTAC = hexadecyl trimethyl ammonium chloride), coating of which onto the surface of large area polycrystalline silicon solar cells (active area: 110 cm^2) results in an increase of PCE from 15.06% to 15.57%. Remarkable stability of the luminescent film was also demonstrated under light-soaking test for 500 h, and no obvious luminescence degradation can be observed. The remarkable enhancement of the conversion efficiency by 0.51% absolute on such a large active area, together with the high stability of the luminescent film, demonstrates a prospect for the implementation of the films in photovoltaic industry.

Słowa kluczowe

ethylene-vinyl acetate, lanthanide complexes, solar cell, Stability

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