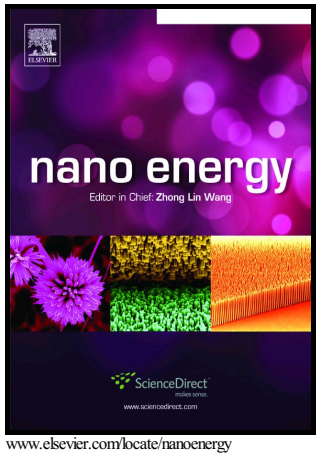

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Metal-organic framework/sulfonated polythiophene on carbon cloth as a flexible counter electrode for dye-sensitized solar cells

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Abstract

Metal-organic framework (MOF-525) is firstly introduced as the electro-catalyst for the counter electrode (CE) of a dye-sensitized solar cell (DSSC). When MOF-525 was mixed with the conductive binder of sulfonated-poly(thiophene-3-[2-(2-methoxyethoxy)-ethoxy]-2,5-diyl) (s-PT), a composite film of MOF-525/s-PT was successfully deposited on a flexible substrate, carbon cloth (CC). The one-dimensional carbon fibers in CC were intended to provide oriented electron transfer pathways as a conductive core, and the composite film of MOF-525/s-PT covered on each carbon fiber in CC was designed to trigger the reduction of I_3^- as an electro-catalytic shell. Thus, a hierarchical electron transfer network was established. In the MOF-525 nanoparticle, its nodes (zirconium oxide) and linkers (meso-tetra(4-carboxyphenyl)porphyrin) were both verified to function as the electro-catalytic active sites for I_3^- reduction. The best MOF-525/s-PT composite counter electrode rendered 8.91±0.02% to its DSSC, showing the promising potential to replace traditional platinum (8.21±0.02%). At dim light condition (10 mW cm^{-2}), the best cell with MOF-525/s-PT composite CE shows a great cell efficiency (η) of 9.75%, which is higher than that of the cell measured at 100 mW cm^{-2}.