Effect of PEG molecular weight on the polyurethane-based quasi-solid-state electrolyte for dye-sensitized solar cells

ABSTRACT

Nanosilica was surface modified with polyaniline and incorporated into polyurethane to form a polymer matrix capable of entrapping a liquid electrolyte and functioning as quasi-solid-state electrolyte in the dye-sensitized solar cells. The effect on the S−PANi distribution, surface morphology, thermal stability, gel content, and structural change after varying the PEG molecular weight of the polyurethane matrix was analyzed. Quasi-solid-state electrolytes were prepared by immersing the polyurethane matrix into a liquid electrolyte and the polymer matrix absorbency, conductivity, and ion diffusion were investigated. The formulated quasi-solid-state electrolytes were applied in dye-sensitized solar cells and their charge recombination, photovoltaic performance, and lifespan were measured. The quasi-solid-state electrolyte with a PEG molecular weight of 2000 $gmol^{-1}$ (PU−PEG 2000) demonstrated the highest light-to-energy conversion efficiency, namely, 3.41%, with an open-circuit voltage of 720 mV, a short-circuit current of 4.52 mA cm^{-2}, and a fill factor of 0.63.