Abstract

Dye-sensitized solar cell (DSSC) is considered one of the most promising and economical emerging solar energy conversion technologies because of its low production cost and potential efficiencies. However, an expensive and scarce platinum (Pt) is used in their counter electrode (CE). Additionally, Pt CE corrodes as a result of the oxidized electrolyte's chemical attack and requires high manufacturing temperatures. This makes the production of DSSC relatively expensive. This research focused on preparing and utilizing zinc sulphide (ZnS) nanoparticles as the CE in DSSC. The nanoparticles were synthesized using the low-cost chemical reduction method. The X-Ray diffraction (XRD) measurement showed high crystallinity of the nanocomposite. The Fourier Transform Infrared (FTIR) measurements showed the presence of Zn-S bond stretching vibrations. As compared to Pt-based CE, ZnS-based CE demonstrated slightly lower conductivity of 54.41 S/m to 379.85 S/m for Pt. Power conversion efficiency (PCE) was noted to improve from 0.07% for unannealed ZnS-based CE to 1.1 % for ZnS-based CE annealed at 400 ^{0}C. The improvement is associated with enhanced crystalline quality of ZnS nanoparticles upon annealing the CE at 400 ^{0}C. Therefore, ZnS nanoparticles show great promise as a cost-effective alternative counter electrode for DSSC with further material properties optimization.