

Effect of Incorporation of Graphene to the Electrolyte on the Performance of Quasi-Solid-State Dye-Sensitized Solar Cells

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This study investigated the use of graphene as a performance enhancer of the electrolyte for dye-sensitized solar cells (DSSC). The electrolyte is a major component that affects the performance of a DSSC, as it can govern both the efficiency and the stability of the solar cell. A gel polymer electrolyte, which shows higher long-term stability while maintaining comparable efficiency, is developed in this study. In this research, a small percentage of graphene is added to an electrolyte containing ethylene carbonate, propylene carbonate, polyethylene oxide, 4-tertbutylpyridine, lithium iodide, tetra-hexyl-ammonium iodide, 1-methyl-3-propyl imidazolium iodide and iodine. The conductivity of the electrolyte and the efficiency of the solar cell are studied. The electrolyte containing 1% graphene mass fraction with respect to polymer demonstrated a higher conductivity of 0.511 mS cm^{-1} at 30°C . A quasi-solid state DSSCs constructed using 6-layered TiO_2 photoelectrodes and Pt counter electrodes exhibited a power conversion efficiency (PCE) of 5.83%, which is 4.3% higher than the control cell. This observation can be attributed to the higher conductivity of the graphene-added electrolyte since graphene may assist charge transportation through the electrolyte.

Keywords: Gel polymer electrolytes, Graphene, High-efficiency DSSCs, Ionic conductivity

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