Improving the Performance of TiO2 Nanorod-Based Dye-Sensitized Solar Cells

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During the past two decades, unique photoelectric properties of titanium dioxide (TiO2) have attracted a lot of interest in the research of dye-sensitized solar cells (DSSCs). One limitation correlating to photoelectrical conversion efficiency would be the proper electrolyte. The type of counter electrode used will also affect the performance of the DSSCs. In this project, both electrolytes and counter electrodes were investigated to improve the conversion efficiency of TiO2-based DSSCs as well as to reduce their cost. For the study of electrolytes, three types of electrolytes were studied: iodine-based electrolyte (I-/I2), sulfur-based electrolyte (S2-/S), and inorganic solid-state electrolyte (CsSnI2.95F0.05). The CsSnI2.95F0.05 demonstrated the highest conversion efficiency of circa. 8.9%, which is much higher than the results of the other two electrolytes (2.14% for I-/I2 electrolyte, and 0.045% for S2-/S electrolyte). For the investigation of counter electrodes, four types of electrodes were examined: fluorine-doped tin oxide transparent conductive glass (FTO), platinum coated FTO (Pt/FTO), graphite coated FTO (Graphite/FTO), and graphite coated common glass (Graphite/Glass). Their optimum photoelectrical conversion efficiencies were 2.17%, 9.82%, 7.62%, and 3.45%, respectively. Our findings indicate that in view of overall performance of TiO2-based DSSCs, solid-state electrolytes can be developed to replace liquid electrolytes, and graphite can replace Pt to reduce the cost of TiO2-based DSSCs.