Design of a Photoanode for its Application in a Photoelectrochemical Cell

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Abstract

Since the pioneering work of Michael Grätzel on utilizing TiO_2 nanoparticles in dye sensitized solar cell (DSSC), much research has been devoted to DSSC research. However, there are a number of challenging issues remaining, for example, insufficient sunlight harvesting by the sensitizer, inefficient electron transport in the photoelectrode and the stability concern. The aim of this work was to investigate ZnO as a semiconductor material in the construction of photoanodes for enhanced DSSC efficiency [1-3].

Au and AuCu nanoparticles are also used in the design of photoanodes. Even when this work has been performed, the use of electrochemical techniques for its construction is of interest, since no treatment has been given to the system after its construction.

The ZnO/Au and ZnO/AuCu photoanodes with the ZnO structure being nanosheet/nanorod on Indium-tin oxide glass from substrate to surface was prepared by electrodeposition method [1-3].

Gold nanoparticles and AuCu nanoparticles are electrodeposited without the presence of an organic stabilizer. The systems ZnO/Au and ZnO/AuCu (electrochemically constructed) are compared with other photoanodes, where Au nanoparticles and AuCu nanoparticles have been anchored to ZnO nanorods by means of an organic stabilizer (colloidally constructed) (Figure 1).

Photoanodes were characterized by several analytical methods, X ray diffraction, scanning electron microscopy, UV-Vis and Raman spectroscopy, and electrochemically. Structural differences were observed between colloidally and electrochemically constructed systems, specially by electrochemical characterization.

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Figure 1. Schematic diagram for the preparation of ZnO/Au systems by using a colloidal method or an electrochemical method.