E1-11: Properties of p-Cu_2O semiconductor thin film made between (Copper & Gold) alloy and Indian Tin Oxide film in a photoelectrochemical cell

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Besides choosing the best redox potential relative to band edges and concentration of a redox system in the electrolyte and the use of electrocatalytical metal submonolayers, it is possible to use electrode coatings to prevent electrolyte attack. For this purpose Indium Tin Oxide (ITO) films were deposited on p-Cu_2O electrodes by the magnetron sputtering technique in order to make ITO protective layer on p-Cu_2O to prevent the photocorrosion of p-Cu_2O with the elecuolyte. A remarkable stability and a photocurrent enhancement was observed. Photocurrent enhancement of p-Cu_2O/ ITO device was further enhanced when the preparation method of p-Cu_2O was changed as follows: Au evoporated (≈20μm) well cleaned copper plate is heated to 700°C 0for 3min to make the Cu+Au alloy with the formation of p-Cu_2O during the heating process. Scaning electron microsopy (SEM) reveals (Cu+Au) alloy is covered from p-Cu_2O grown from copper substrate during the heating. Also XRD data confirms, the formation of Cu+Au alloy and p-Cu_2O on the copper substrate. Considerable photocurrent enhancement and a stability can be observed for Co / (Cu+Au)/ p-Cu_2O/ITO photoelectrodes in KI (10^{-2} M) + I_2 (10^{-4} M) electrolyte solutions. Here, the Au particles in the alloy provide a large surface area to collect holes from p-Cu_2O since Au is a good hole transfer catalyst. Photogenerated electrons tunnel to the electrolyte through the ITO film effectively. Here ITO film protects the p-Cu_2O photocrrosion, since ITO film prevents the contact of the electrolyte species.

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