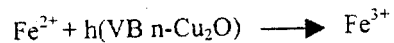


## E1-09: H<sub>2</sub> evolution from n-type photoresponse of Cu<sub>2</sub>O with Fe<sup>2+</sup>/Fe<sup>3+</sup> redox couple

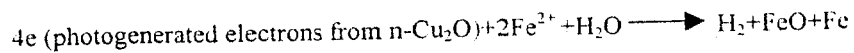
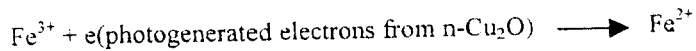
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Searching for solar energy materials in making high efficiency solar cells is of importance. Cuprous oxide is an excellent material which can be fabricated at extremely low cost. Recent investigations on the n-type photoresponses of Cu<sub>2</sub>O has attracted attention of scientists. In this report remarkable H<sub>2</sub> evolution rate with n-type Cu<sub>2</sub>O in the presence of Fe<sup>2+</sup>(10<sup>-2</sup>M)/Fe<sup>3+</sup>(10<sup>-4</sup>M) redox couple is presented. Obtained photocurrents were in the range of 1.5 mA cm<sup>-2</sup> with visible light irradiation of 250 W cm<sup>-2</sup> tungsten filament lamp. Samples were prepared by immersing a well clean Cu plate into a CuSO<sub>4</sub> 10<sup>-3</sup>M solution for 2 days. XRD measurements show that formed layer is entirely Cu<sub>2</sub>O. Formation of CuO is non-significant in the XRD spectrum. Photocurrents were measured with 3 electrode configurations. A Pt (1cm x 1cm) plate was used as the counter electrode. H<sub>2</sub> bubbling can be observed on the Pt electrode under illumination. The most likely reaction involved in the H<sub>2</sub> evolution can be presented as follows with the presently available knowledge i.e. at the Pt electrode:

At working electrode n-Cu<sub>2</sub>O/electrolyte interface:



At counter Pt electrode/electrolyte interface:



After several hours, a black precipitate, a mixture of FeO and Fe (product) deposits as an amorphous material according to the XRD measurements. This H<sub>2</sub> evolution rate is strongly dependent with the applied potential and the size of the crystallites. The highest H<sub>2</sub> evolution rate  $\approx 2 \times 10^{-2} \text{ mol l}^{-1} \text{ min}^{-1}$  was observed around the applied potential +0.12 vs SCE. According to the scanning electron

micrography (SEM), the sample formed crystallites that are hexagonal with n-type material. The highest H<sub>2</sub> evolution rate observed is of the order  $\approx 10^{-2}$  mol l<sup>-1</sup> min<sup>-1</sup>. Evolved H<sub>2</sub> gas was confirmed with gas chromatography and the rough titration methods. This H<sub>2</sub> evolution is visible and presented originally with n-Cu<sub>2</sub>O from this investigation. This is a good example for practical devices in the near future after improvement.

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