4.2 Electrodeposition of Nanocrystalline Cuprous Oxide Thin Films for Solar Energy Applications

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ABSTRACT

Non-toxic semiconducting cuprous oxide thin films are used in the development of photovoltaic and PEC solar cells because of the favourable band gap, low cost and abundancy of cuprous oxide. Electodeposition technique for preparation of thin cuprous oxide films is very important because it is simple, inexpensive and can be used to control the conductivity type. The conductivity type is determined by the pH and the cupric ion concentration of the film depositing bath. In general the n-type films are produced in acidic baths while and the p-type films are produced in alkaline baths. The grain size in cuprous oxide thin films is a key to improve the performance of solar application devices. Nanocrytalline thin films would be very important in developing PV solar cells and PEC devices because of the order of magnitude increase in effective surface area of the films as compared with the microcrystalline thin films. Also, it gives the possibility of developing nanocrystalline p-n junction diodes for solar cell applications. Therefore it is important to develop techniques for producing nanocrystalline cuprous oxide thin films. Structural and morphological studies revealed that the films of nanocrystalline size (100 nm) can be electrodeposited by controlling the deposition parameters. Spectral response measurements of the films demonstrate the p-type behavior in a photoelectrochemical cell. Analysis of the X-ray diffraction (XRD) data agrees with the observation made with scanning electron microscope (SEM).