

Characterization of cuprous oxide thin films on n-Si substrate prepared by sol-gel spin coating

Abstract

Cuprous oxide films were successfully grown onto a n-Si substrate with (100) orientation via sol-gel spin-coating method at room temperature in air followed by annealing in 5% H₂ + 95% N₂ atmosphere. The annealed temperatures were varied between 350-550 °C. The crystallinity and morphology of the oxide thin films were studied by grazing angle X-ray diffractometer (GAXRD) and scanning electron microscopy (SEM), respectively. GAXRD indicated that the crystallinity of the films increased with higher annealing temperature. SEM images revealed that the Cu₂O films form irregular grain size instead of smooth film which indicated the film growth followed Volmer-Weber growth mode. The size and shape of cuprous oxide grains also changed with temperature. Irregular shape with average size of 100 nm can be seen at annealed temperature 350 °C which evolved into rectangular like shape with average size of 200 nm at annealed temperature 550 °C. Optical reflectance revealed similar pattern for each film at wavelengths below 480 nm. It is believed that the absorption is due to energy gap of Cu₂O. The maximum reflectance for each film also varies which may be due to different coverage and size of the grains.

Keywords — Cuprous oxide, sol-gel, n-Si, thin films, scanning electron microscopy (SEM)