GROWTH AND PROPERTIES OF SPRAYED IRON DISULFIDE(FeS_2) THIN FILM

By

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A Thesis submitted to the University of Nairobi in partial fulfillment of the requirements for the degree of Master of Science

1997

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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ABSTRACT

Recently, iron pyrite (FeS_2) has been considered as a potential material for thin film solar cells and wet cells. In the present work pyrite FeS_2 films have been grown by spray pyrolysis followed by sulfidation.

The deposition parameters were identified and their optimum values determined. The following values were found: temperature ~ 500°C, spray rate ~ 24 cm^3/min, and substrate to sprayer nozzle distance ~ 35 to 40 cm. The contents $FeCl_3$:$CS(NH_2)_2$:H_2O of the spraying mixture were found to be in the volume ratios 0.07:0.15:0.78 for molarities in the range 0.1 and 1 while for molarities less than 0.1 the volume ratios were 1:2.

Transmission data analysis in the wavelength range 0.4 μm and 0.8μm gave an indirect energy gap ~ 1.17 eV, a possible direct band gap ~ 2.60 eV and an absorption coefficient ~ $10^4 cm^{-1}$. Sulfidated samples showed absorption coefficient of ~$10^5 cm^{-1}$. The structural analysis revealed an improvement in the crystallization with the increasing sulfidation temperature. The films showed a preferred orientation in the (200) direction. Electrical transport properties study indicated that the films exhibit n-type conduction. The carrier concentration was found to be n ~ $(0.15 - 0.23)x10^{17}$ cm^{-3}, the Hall mobility μ_H ~ 0.6 to 1.5 $cm^2V^{-1}s^{-1}$ and the Hall constant R_H ~ $(-4.2$ to $-2.3)x10^2$ cm^3c^{-1}.