

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

By

LONA NDJELI

THIS THESIS HAS BEEN ACCEPTED FOR
THE DEGREE OF *MSc* 1997
BY THE UNIVERSITY OF NAIROBI

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.



LONA Ndjeli

University of Nairobi

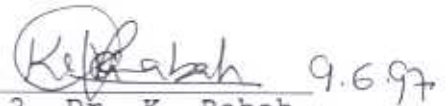
This thesis has been submitted for examination with the approval of my University Supervisors:



1. Dr. A. K. Raturi

Department of Physics

University of Nairobi.



2. Dr. K. Rabah 9.6.97

Department of Physics

University of Nairobi.

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 = $24 \text{ cm}^3/\text{min}$, and substrate to sprayer nozzle distance = 35 to 40 cm. The contents $\text{FeCl}_3:\text{CS}(\text{NH}_2)_2:\text{H}_2\text{O}$ 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 $0.4 \mu\text{m}$ and $0.8 \mu\text{m}$ gave an indirect energy gap = 1.17 eV , a possible direct band gap = 2.60 eV and an absorption coefficient = 10^3 cm^{-1} . Sulfidated samples showed absorption coefficient of $\approx 10^5 \text{ cm}^{-1}$. 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 $n \approx (0.15 - 0.23) \times 10^{17} \text{ cm}^{-3}$, the Hall mobility $\mu_H \approx 0.6$ to $1.5 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ and the Hall constant $R_H \approx (-4.2$ to $-2.3) \times 10^2 \text{ cm}^3 \text{ C}^{-1}$.