OPTICAL AND ELECTRICAL PROPERTIES OF THERMALLY DEPOSITED ALUMINIUM THIN FILMS

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Order of Presentation

- Introduction
- Objectives
- Significance of the study
- Materials and Methods

Introduction

- A thin film is a layer of material ranging from fractions of a nanometer to several micrometers in thickness. Thin film deposition is the act of applying a thin film of material onto a substrate (Rao and Shekhawat, 2013). For example a household mirror.

- Thin film technologies are a means of substantially minimizing the cost of solar cells, this is because thin film solar cells are cheaper to manufacture due to their reduced material costs, energy costs and handling costs.

- Aluminium thin films have great coating properties required for optical, microelectronics, telecommunication and constructional applications (Frey, 2015).

Introduction Cont'd

- Physical vapour deposition (PVD) of aluminium thin film is preferred to chemical vapour deposition (CVD) because it is environmentally cleaner and produces higher adhesion (Panta and Subedi, 2012).

- Thermal evaporation is one of the PVD technique used for film deposition.

Objectives of the Study

General objective

- The main objective of the study is to investigate the optical and electrical properties of thermally deposited aluminium thin films.

Specific objectives

The specific objectives of the research are to:

1. To determine the effect of deposition angle on optical and electrical properties of aluminium thin films.
2. To determine the effect of target size on optical and electrical properties of aluminium thin films.

Significance

- The results of the study will be useful in the manufacture of reflectors in solar concentrators and solar cookers.
- Aluminium thin films will be used in electronics such as connections in semiconductors, integrated circuit devices, electrodes and back contacts in solar cells.
- The study will also improve people's standards of living through the invention of lighter weight, more advanced, durable, stronger and more efficient products.

Materials and Methods

Materials

- Aluminium wire, glass slides, ultrasonic cleaner, Edwards auto 306 vacuum coater, jandel multi height four point probe, lambda 19 spectrophotometer and a metre rule.

Methods

- An ultrasonic cleaner will be used for cleaning the substrate to remove all the stains from it along with distilled water, soap and ethanol.
- Aluminium thin films will be deposited by thermal evaporation while reflectance and transmittance of aluminium thin film will be determined by lambda 19 UV/VIS/NIR spectrophotometer.

Materials and Methods (cont'd)

- Sheet resistance will be determined by the jandel multi height four point probe while the deposition angle will be changed by the angle rotator in the vacuum coater and the target size will be determined using a metre rule.
- For the case of thin metallic films, the electrical resistivity (ρ) of the film, whose length is much longer than its thickness d can be obtained by formula as expressed below;

Materials and Methods (cont'd)

$$\rho = \frac{\pi}{\ln(2)} \frac{V}{I} \times d, \tag{1}$$

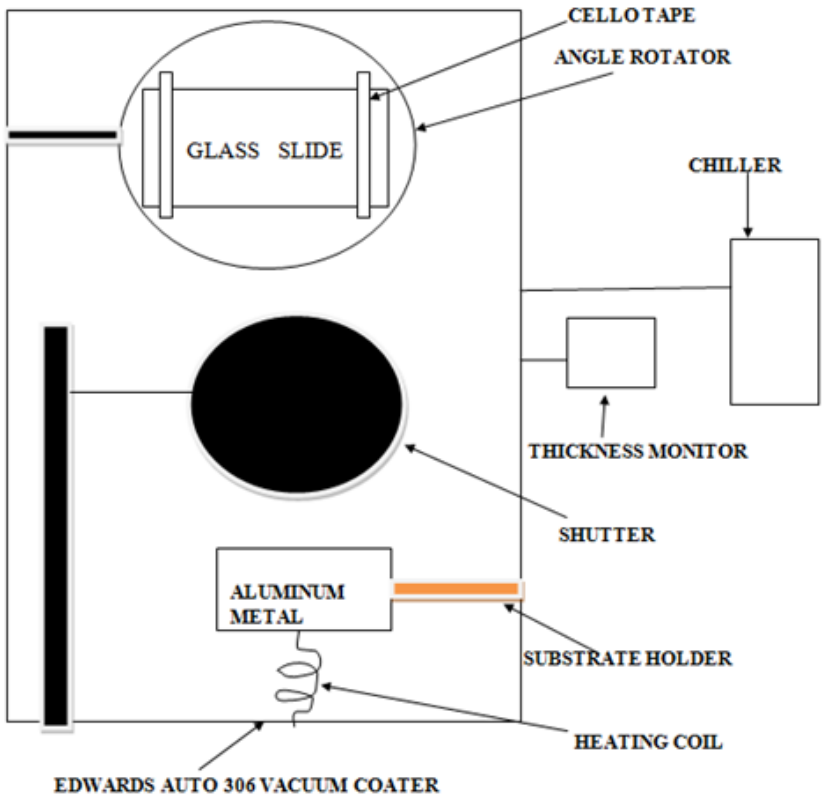
$$\rho \approx 4.532 \frac{V}{I} \times d, \tag{2}$$

Where V is the voltage in mV, I is the current in mA and the spacing between two point electrode is 1.5 mm. Knowing the values of (ρ) and thickness of thin films, the sheet resistance can be determined according to the expression below;

$$R_s = \frac{\rho}{d}. \tag{3}$$

Materials and Methods (cont'd)

Deposition of aluminium thin film on oblique glass



Materials and Methods (cont'd)

- The target size will be determined using a metre rule.

Data Analysis

- The collected data will be presented and analysed using tables, graphs and statistical parameters shall be compared for deposition angle, sheet resistance, target size, reflectance and transmittance.

References

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THANKS FOR LISTENING