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Properties of Physically Deposited Thin Aluminium Film Coatings: A Review**F.M. Mwema¹, O. P. Oladijo^{2*}, S.A. Akinlabi¹ and E. T. Akinlabi¹**¹Department of Mechanical Engineering Science, University of Johannesburg, South Africa²Department of Chemical, Materials and Metallurgical Engineering, Botswana International University of Science and Technology, Botswana*Corresponding Email: seyiphiphilip@gmail.com**Abstract**

Aluminium thin films exhibit excellent coating properties suitable for optical, microelectronics, telecommunications and constructional/structural applications. Thin aluminium film deposition is mainly accomplished via physical or chemical methods at varying deposition conditions, parameters and substrates. This study focuses on thin aluminium films prepared using physical methods which have superior properties to chemical methods and are extensively researched in the published literature. The review discusses the properties of thin aluminium films and their complex interactions with process parameters. The properties of thin films depend on the deposition parameters which include substrate temperature, deposition rate, power, process pressure, substrate surface finish, and target temperature. Post-deposition treatment of the films and the type of substrate also influence the properties of thin films. This review therefore highlights the significance of optimising the deposition methods and identifies research gaps in the published studies. The work can be a primary resource for selection of essential process parameters during physical deposition aluminium films.

Keywords: aluminium, thin films, corrosion, electrical, optical, physical deposition, properties

1.0 Introduction

Pure aluminium (Al) films find application in the optical, microelectronics, telecommunications and construction/structural industries due to their excellent properties such as high conductance, low resistivity, high reflectance, better adhesion, resistance to oxidation and corrosion [1]. The naturally formed thin layer of oxide on pure aluminium film further imparts optical, thermal, electrical and chemical enhancing properties to the coating. Aluminium thin films continue to receive high industrial and research interest because, successful depositions have been achieved using a broad spectrum of substrates including mild steels, stainless steel, titanium, silver, silicon (100), Polyethylene Terephthalate (PET), polycarbonates, and glass [1, 2]. Thin aluminium film, the deposition parameters of which make tuning them for specific applications possible, is achieved through physical and chemical methods. The existing literature shows a significant preference for physical methods which mainly include thermal and vapour deposition. Physical deposition methods produce higher adhesion, lower substrate temperatures, and are environmentally cleaner [3]. The main drawback of chemical techniques is the use of toxic solvents such as hydrazine which is

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