ELECTRICAL PROPERTIES OF TITANIUM DIOXIDE THIN FILMS PREPARED BY SOL-GEL METHOD FOR SOLAR CELL APPLICATION

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ABSTRACT

Titanium dioxide (TiO_2) thin films were prepared by sol-gel method at various annealing temperatures and at different concentration of titanium (IV) isopropoxide. TiO_2 thin films have been deposited on silicon substrate by spin coating technique. In general, the preparation conditions of TiO_2 thin films by a sol-gel process can strongly affect the surface morphology and electrical properties of the TiO_2 thin films. The surface morphology and electrical properties were investigated by scanning electron microscopy (SEM) and current-voltage (I-V) measurement, respectively. The interconnected pores closed up during sintering process and the porosity is found to affect the resistivity of TiO_2 thin films and the concentration of titanium (IV) isopropoxide is also found affecting the resistivity. The resistivity increases when the concentration of titanium (IV) isopropoxide increases. The resistivity also increases with increase of annealing temperature.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Titanium dioxide (TiO_2) thin films have been extensively investigated in relation to different applications related to surface properties, in the fields of gas sensing, photo-catalysis or solar cells [1]. TiO_2 thin films have been receiving much attention in the past as their chemical stability, high refractive index, and high dielectric constant allow their use as components in optoelectronic devices, sensors and photo-catalysis [2].

TiO_2 thin films have been made by a variety of techniques such as e-beam evaporation, magnetron sputtering technique, anodization, chemical vapour deposition (CVD) and sol gel technique. Among the different methods for the preparation of TiO_2 electro-chromic thin layer, sol gel method has many advantages, particularly the possibility of producing large surfaces [2].

The films are generally deposited by dip-coating, but may also be deposited using spin coating [2]. The sol gel processes are particularly efficient in producing thin, transparent, multi-component oxide layers of many compositions on various substrates, including glass. The sol-gel process is one of the most appropriate technologies to prepare thin oxide coating. The interest in the use of sol-gel method is due to several advantages: good homogeneity, ease of composition control, low processing temperature, large area coatings, low equipment cost and good optical properties [3].