CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF PROBLEM

Metallic oxides are one of the transparent semiconductors that having abundant application in industry. Indium tin oxide (ITO) is an example of metallic oxide which commonly referred to ITO thin films. Some of us did not aware of extraordinary chemical and physical properties which are characterize in ITO’ particles. The spectral transmittance and simulation software can be used to determine the real significant of ITO in terms of its presence as n-type conductivity and a wide bandgap.

As already mentioned above, ITO has a wide bandgap which is about >3.5 eV. It is n-type semiconductor with excellent substrate adherence and great electrical conductivity (Ojo Adurodija, 2002). That is why coating electrodes for optoelectronics especially films in solar cells used ITO as its primary source (Harith Ibrahem et al., 2013). Here tin acts as a cationic dopant and a substitute on the indium sites to bind with the interstitial oxygen.

Indium Tin Oxide is known as beneficial semiconductor which contributes more in industry when it is synthesized as a thin film. Thin film is known as a very thin layer of material coating. Thin film deposition is one of the procedures used to apply a very thin film of material onto a substrates’ surface. This process is mainly used in optical devices and semiconductor industries. Thin film deposition commonly divided into two groups which are physical and chemical decomposition. Zhou et al., 2007 has reported that vacuum-based deposition method is costly and require complicated equipment. Chemical vapor deposition (CVD), laser ablation, spray pyrolysis and
sputtering are some examples of vacuum-based deposition. In addition, physical deposition or also known as solution-based deposition methods used thermodynamic, electrochemical and mechanical procedure where the releasing material from a source is deposited on a substrate. Chemical bath decomposition (CBD), electrodeposition, hydrothermal and sol gel process are the examples of solution-based deposition method (BIAN et al., 2008). Among these solution-based deposition, sol-gel method becomes the greatest choice in industry due to its ability in obtaining high purity materials using simple equipment with reasonable price (Harith Ibrahem, 2013).

To the best of my knowledge, the study of ITO synthesized by sol gel method on quartz substrate have rarely reported. Thus, in this contribution, we study the properties of ITO deposited on two different substrates which are glass and quartz. In particular, we have focused on morphologies and optical properties of ITO thin films.

1.2 STATEMENT OF PROBLEM

Historically, ITO films are used widely and becomes priority in semiconductor industry. As concrete integrated apparatus used ITO as its main source, fine patterning is required in order to gain quantified fine patterns. These patterns are quite hard to quantify via wet and dry etching which both are the example of chemical etching methods (Park et al., 2005). The study before reported that various procedures like spray pyrolysis and thermal hydrolysis are used to obtain ITO nanoparticles. However, these methods were unsuccessful because the oxide produce high degree of agglomeration. Among these techniques, the sol-gel method has its own benefits which are the possibility of obtaining high purity materials using modest equipment and the ability to synthesis ITO in the form of thin films (Silva et al., 2012).

In this work, sol gel method is used to fabricate ITO films on two different substrates and hence the structural and optical properties will investigated.
1.3 OBJECTIVES OF STUDY

The objectives of this study are:

1. To synthesis ITO thin film deposited on two different substrates.

2. To study the structural characteristics of ITO thin films deposited on two different substrates using XRD and FESEM.

3. To determine the band gap of ITO thin films and study their optical effect on two different substrates using UV-Vis spectrometry and PL spectroscopy.

1.4 SCOPE OF THE STUDY

This study is mainly focus on characterizing the structural and optical properties of sol gel Indium Tin Oxide (ITO) thin films using different substrates. The substrates are concentrated on glass and quartz only.

For structural studies, the structural characteristics of ITO are investigated using non-destructive method such as FESEM and XRD. Apart from that, for optical studies, the optical effect of ITO are investigated using UV-vis spectrometry and PL spectroscopy.

The attention of this study is to focus on substrate effects on structural and optical properties of Indium Tin Oxide thin films by sol-gel method.