UNIVERSITI TEKNOLOGI MARA

SYNTHESIS OF TIN OXIDE FILM FROM TIN OCTOATE USING SOL-GEL DIP-COATING METHOD ON GLASS SUBSTRATES

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ABSTRACT

The work presented in this thesis deals with experimental and theoretical studies related to tin oxide, SnO_2 thin films. Tin oxide widely used in optical and electronic applications. The main purpose of this research is to synthesis and to characterize the SnO_2 film for coating on a glass substrate by using a sol-gel dip-coating method. The crucial part of this study was the formulation of the coating solution. Therefore, the effect of solvent, acid catalyst, aging time and binder on viscosity also was investigated in this study. Tin octoate was used as the main material that acts as a precursor, Ethylene Glycol (EG) as a solvent and Nitric acid (HNO_3) as a catalyst. In this research, SnO_2 thin film was synthesized through the sol-gel method with the addition of an organic binder which is Polyethylene glycol (PEG). The obtained gel and coated substrates were then dried at 200 °C. Chemical properties of SnO_2, were characterized using FTIR, XRD and SEM-EDX to study the structural/bonding determination, phase of the coated samples and also the surface morphology of sol coatings on the glass substrate and sol powder after drying. Besides that, mechanical properties also studied using adhesion tests on the coated layer. The best formulation for coating solution to obtain SnO_2 film was arbitrarily selected at 1:10:1 represent $Sn(Oct)_2$, E.G and HNO_3 respectively at 24 h .and concentration of PEG binder used was 8g. This formulation gives a viscosity range of 40cp which was suitable for coating on glass substrates. Based on the FTIR result, Sn-O and Sn-O-Sn bonding were obtained on the absorption peak between 500-700nm. XRD result also shows the phase of SnO_2 obtained by referring XRD pattern from (JCPDS file No.86-2265), it shows peaks of both the tetragonal structure of Sn and SnO (JCPDS file No. 06-0395). However, the result indicates that this temperature (200°C) tin not fully oxidized yet. In addition, it was clearly observed that tin, Sn dominated the composition of the element on the SnO_2 coating film by 68.30 %, followed by oxygen, O (28.32 %) and, carbon, C (3.38 %) when characterized using EDX. In this research, the average thickness of the thin film was 256 μm. Thus, it shows the thickness of the coating was proved by the illustrations made in by the SEM micrograph. Last but not least, an adhesion test showed 66.7% was peeled off from the surface of the glass when no PEG binder was added compared with only 26.7% was peeled off from the surface for a coating solution with a binder. This can be concluded that an addition of binder can help to produce a better adhesion result which leads to producing a stronger film.

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