EFFECT OF ZrO_2 ON THE STRUCTURE, HARDNESS AND HUMIDITY SENSING PROPERTIES OF TiO_2-ZrO_2

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Final Year Project Submitted in
Partial Fulfilment of the Requirement for the
Degree of Bachelor of Science (Hons.) Physics
In the Faculty of Applied Sciences
Universiti Teknologi MARA

JULY 2017

ABSTRACT

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The influence of ZrO_2 on the structural, hardness and humidity sensing properties of the TiO_2 ceramics were investigated. The samples were prepared by the conventional ceramic method. The samples were characterized on their structure, hardness and humidity sensitivity. Analysis on the hardness properties has been carried out using Vickers hardness and bulk density method. It shows that hardness of samples do not affected by the bulk density. Field Emission Scanning Electron Microscopy (FESEM), X-ray Diffractometer (XRD) and impedance spectroscopy method were used for characterization the microstructure and sensing properties of samples. The average grain size shows significant difference between each samples. The XRD analysis support the characteristic of the average grain size of the samples. The ratio of impedance indicate the sensitivity of samples. Sample with ZrO_2 addition of 20 wt% have the highest ratio of impedance and sensitivity for ceramic composite rather than other samples at two different %RH which is 56 %RH and 27 %RH.

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CHAPTER 1

INTRODUCTION

1.1 Background of study and problem statement

A sensor is a device that detects and responds to some type of input from physical environment such as light, heat, motion, moisture and pressure. Sensors have become an integral part of all advance technology in recent years (Jain *et al.*, 1999). Pressure sensors, temperature sensors, biosensors, gas sensors, motion sensors and humidity sensors are few examples of sensors (Chen and Lu, 2005; Patel *et al.*, 2012).

Humidity sensing materials have been extensively studied as it is the heart of humidity control devices. Humidity sensors needs to be studied because it is important in human life and industrial applications amongst assorted type of sensors (Kim *et al.*, 2005; Traversa, 1995; Rittersma, 2002; Chen and Lu, 2005; Zhang *et al.*, 2010). Humidity sensor senses, measured and reports the relative humidity in the air, and humidity measurement is important in the modern industrial applications (Tripathy *et al.*, 2014; Su *et al.*, 2015; Sikarwar and Yadav, 2015; Jung and Ji, 2014).

Ceramics are preferable rather than polymers and composites as humidity sensing materials because of their chemical and physical stability in the environment, which is suitable for applications, processing ability and