CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Zinc oxide is widely applied in many fields due to its physical and chemical properties. In medicine field, ZnO used for skin treatment purposes such as minor burned and diaper rash. It mixed with stearic acid for vulcanization of rubber to produce tires and shoe soles. Besides that, ZnO is applied in solar cell technology. It is fabricated as first layer of Copper Indium Gallium Selenide (CIGS) as a buffer layer to increase the efficiency of the solar cell. It also been applied in nanotechnology devices such as nanowires. Crystal growth of ZnO had gained attention different type of ZnO crystal which carried its own characteristics and thus benefit in manufacturing the devices. Fabrication of each of the product depends on characteristics of ZnO crystal. The more the type of crystal growth discover, the more beneficial it brought to consumers.

In recent years, nanocrystals of ZnO are being further studied in application of optoelectronic devices. Characteristics of ZnO crystal grew such as size, phases, piezoelectricity and others brings an effect in the application. Thus a lot of research had been done to determine the growth of ZnO crystals. Many methods were being studied to grow ZnO crystals which included sputtering (K. K. Kim, etc, all., 2000), thermal evaporation (B. D. Yao, etc, all., 2002), metal-organic vapor-phase epitaxy (MOVPE) (W. I. Park, etc, all., 2002), molecular beam epitaxy (MBE) (M. Kawasaki, etc, all., 1998) and pulsed-laser deposition (PLD) (M. Kawakami, etc, all., 2003). However, electric current heating method was adopted in this research. This main reason for heating ZnO bar by using electric current is to achieve one of the objectives to grow
various forms of ZnO crystals. The method of electric current heating is more encourage the growth of various form of crystals.

1.2 PROBLEM STATEMENT

Zinc Oxide (ZnO) exists in different crystal structure under specific condition. All type of crystal growth consists of different characteristics. Crystal growth is important for understanding physiochemical mechanisms for zinc oxide. One of the major problems for growing the zinc oxide crystal is to provide high power to conduct electricity. Thus, joule heating method has been selected to conduct electricity in the research. Joule heating method provides a stable and continuous current and high applied voltage throughout the circuit. New form of crystal growth of zinc oxide is wished to be observed through this research.

1.3 OBJECTIVE OF RESEARCH

There were several objectives set as target to be investigated in this research. It aimed to achieve the following objectives:

i. To grow various forms of zinc oxide crystals possibly the new ones by applying an optimum current density in the heating of zinc oxide ceramic bars (joule heating).

ii. To master in joule heating process.

iii. To characterize samples using X-ray Diffraction, Scanning Electron Microscopy, Ultraviolet-visible Spectroscopy and Photoluminescence Spectroscopy and analyze and identify various crystal growth.
1.4 SCOPE OF STUDY

The scopes of study of the research were:

i. For synthesis the zinc oxide bar for joule heating process.

ZnO is a semiconductor material with wide bandgap and thus it needed large amount of current density to excite electrons and conduct electricity. Thin and small pellet bars of zinc oxide were synthesized to reduce the current density needed for exciting electrons. In this research, ZnO was grinding until fined particles with mortar and pestle to form rectangular pellet bar with different pressure.

ii. To master in conducting joule heating process.

Joule heating process provided high density current flow through the circuit. Circuit set up was important to make sure the current flow through the circuit. High resistivity connecting wires were chosen to avoid the connecting wire from burning off. ZnO bars were hold with crocodile clip at both end tip to increase the surface for crystal growth. ZnO bars must be hold tight enough to avoid leakage of current density from the circuit.

iii. To characterize samples using X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Ultraviolet-visible Spectroscopy and Photoluminescence Spectroscopy.

Results of characterization were analyzed to discover the crystal growth of ZnO. XRD was to check the composition of ZnO whereas SEM was to check the topography of crystal growth. Ultraviolet-visible Spectroscopy and Photoluminescence Spectroscopy were used to check the emission intensity of crystal.