CONTEMPORARY METALLIC MATERIALS

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Chapter 024

Study on Zinc Oxide Crystal Growth

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Keywords: Crystal growth, Zinc oxide, DC heating

Abstract: Zinc oxide (ZnO) crystals for various applications could be created and as far manufacturing ultraviolet laser and photodetectors. Zinc oxide (ZnO) crystals are synthesized by applying electric current on ZnO ceramic bar which are made using powder metallurgy method. Scanning Electron Microscope (SEM) and X-Ray Diffractometer (XRD) were used to characterize ZnO sintered bars. Different types of crystals are produced such as polygonal, broken stick, flowers, trunks and many more when DC heating was applied until the sample of ZnO glowed and broke apart. The loads or pressure and heating method to the sample of ZnO affected the types of crystal growth. The optimum load was 3 metric tonne and would ease the ignition during DC heating due to less porosity of the samples.

Introduction

Zinc oxide (ZnO) is a unique material to be used as semiconducting, piezoelectric, solar cells, transparent electrodes and blue/UV light emitting devices. ZnO is most suitable applied for short wavelength optoelectronics devices because of wide band-gap (3.37 eV) compound semiconductor. ZnO has higher exciton binding energy (60 meV) compared to other semiconductor materials and its more resistant to radiation, and is multifunctional with uses in the areas as a piezoelectric, ferroelectric and ferromagnetic. Most of the researchers are focused on ZnSe and GaN materials for commercial interests when to development of short wavelength semiconductor diode lasers without consider of ZnO. In fact, ZnO has a large exciton binding energy of 60 meV, which in principle should allow efficient excitonic lasing mechanisms to operate at room temperature. Furthermore, it is a piezoelectric material with conducting properties. Due to these features, especially after the report about its ultraviolet laser emission, ZnO becomes the promising material for application in light emitting devices (LDs and LEDs) in short range. From this report, ZnO 99.9% powder is used to fabricate sintered bars by using powder metallurgy techniques through uniaxial compaction of the powder and sintering process. The bars fabricated will be joule heated by supplying direct current so that the crystals will grow. The crystals are very useful in the UV light emission and photo detection applications. The goal has focused to grow a variety form of crystals, most probably the novel ones by applying an optimum current density during heating the ZnO ceramic bars with and without the help of Cu tape.

Experimental

Materials