Growth of Zinc Oxide (ZnO) Nanorods and Their Optical Properties

L.M. AL-Harbi & E. H. El-Mossalamy
Department of Chemistry, Faculty of science, King Abdul Aziz University
Jeddah 21589, Kingdom of Saudi Arabia
E-mail: sbdmina@yahoo.com & lmajeed2002@yahoo.com

H.M.Arafa
Chemistry Department, Faculty of Science, Tabuk University
P.O.Box 741 Tabuk 71491, Saudi Arabia
E-mail: han.m.a.2008@hotmail.com

A.Al-Owais
Chemistry Department, King Saud University
P.O.Box 272047, Riyadh-11352, Saudi Arabia
E-mail: aowais21@yahoo.com

M. A. Shah (Corresponding author)
Department of Physics, Faculty of science, King Abdul Aziz University
Jeddah 21589, Kingdom of Saudi Arabia
E-mail: shahkau@hotmail.com, sashraf@kau.edu.sa

Received: November 13, 2010 Accepted: February 22, 2011 doi:10.5539/mas.v5n2p87

Abstract

We herein, report growth of zinc oxide nanorods by a simple reaction of zinc powder and de-ionized water at very low temperature of ~ 110^{o}C without using any organics. The formation of nanorods by the reaction of metals with water is suggested to occur due to the decomposition of water. The decomposed water produces controlled supply of OH^- which further reacts with metal to form ZnO and releases hydrogen. The synthesized ZnO products were characterized in terms of their structural and optical properties. It was observed that the grown nanorods possess good optical property. Compared with other methods, the present method is simple, soft, inexpensive and environmentally benign which will make it suitable for large-scale production for devices and other applications.

Keywords: Soft synthesis, Nanorods, Structural and optical properties

1. Introduction

Zinc oxide (ZnO) is rapidly gaining credibility as a material with excellent possibilities for electronic and photonic devices. Owing to the semiconducting and piezoelectric dual properties, novel applications are introduced which have profound effect in many areas such as self-powdered nanodevices and nanosystems. The demonstration of room temperature ultraviolet lasers, field effect transistors and field emission arrays based on zinc oxide nanorods have stimulated great interest in developing functional nanodevices (C. Klingshrin, 2007)(Z.L. Wang, Z.L, Mater, 2004). Moreover, the wide range of morphological diversity in the nano-regime has made this material a promising candidate in the field of nanotechnology and opened up new possibilities for the fabrication of high performance devices based on these nanostructures. Among the various shapes of nanostructures, one dimensional (1D) nanostructures have received considerable attention due to their potential interests for understanding fundamental physical concepts and for efficient field emission that has enormous commercial applications (Z.W. Pan, Z.R. Dia and Z.L. Wang, 2001)(X. Wang, J. Sang and Z.L.Wang, 2007)(X. Fang, L. Zhang, 2006).

Research in the past have shown that once materials are prepared in the form of very small particles, rods, wires, they change significantly their physical and chemical properties something to the extent that completely new phenomenon are established. While nanomaterials have been generated by physical methods, chemical approaches have proved to be more effective and efficient as they provide better control over the size and shape, which is one of the essential features of nanomaterials. Chemical synthesis of nanomaterials has been reviewed by few authors but innumerable improvements and better methods are being reported continually in the last few years. Among the physical methods, chemical and physical vapour deposition, thermal reduction route, template