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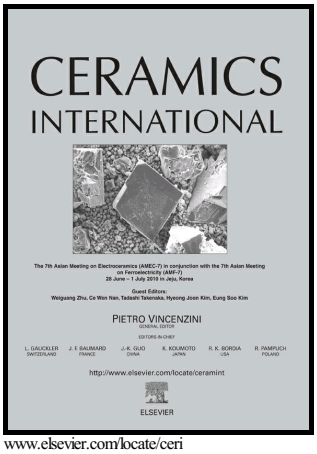

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Growth and optical properties of hierarchical flower-like ZnO nanostructures

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Abstract

The integration of low dimensions nanoscale building blocks into 3D architectures has attracted great scientific attention. We have obtained the novel hierarchical flower-like ZnO nanostructures self-assembled by nanorods via a facile hydrothermal method. The as-synthesized samples were characterized with various technologies. The field emission scanning electron microscope (FESEM) images indicated that hydroxide ions play a significant role on the formation of hierarchical flower-like ZnO nanostructures. The X-ray diffraction (XRD) result proved that the nanocrystals were well crystallized hexagonal wurtzite structure. A possible growth mechanism of the nanostructures was proposed based on the effects of hydroxide ions. And the TEM imagines provided some important evidence for the proposed growth mechanism. UV-Vis adsorption and photoluminescence (PL) spectra results indicated that the obtained ZnO nanostructurs have a good optical-absorption and photoluminescence property. The as-synthesized ZnO nanostructures exhibited superior photocatalytic performance, which was higher than that of commercially available ZnO.

Keywords: flower-like ZnO, hydrothermal, growth mechanism, optical property, photodegradation

1. Introduction

It is an imperative to find efficient materials to cope with the environmental pollution and the energy crisis under the increasingly severe ecological environment. The traditional methods include physical adsorption, chemical oxidation [1,2], microbial processing [3,4] and so on. However, these are limited to a certain extent for their poor efficiency, incomplete degradation of pollutants, narrow range of application and high cost. A tremendous efforts have been devoted to semiconductor-based photocatalyst [5-7] for their inexhaustibility, universality, and environmental benignancy of solar energy since semiconductor oxide photocatalysts were first discovered [8]. Among these wide varieties of semiconductors，ZnO has been mostly studied due to its superior properties with a high electron mobility and a large exciton binding energy of 60 meV [9] .

It has been reported that the properties and functions of ZnO can be greatly associated with its microstructures [10], especially, their morphologies and dimensions. To date, ZnO with different nanostructures has been fabricated via various methods [11-18]. The dimensions of ZnO have