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Mechanochemical transformation of ZnO₂ to highly defective ZnO

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Abstract

The mechanochemical reaction of zinc peroxide (ZnO₂) with zinc (Zn) and copper (Cu) metal powders was examined. Ex-situ characterization of samples was adopted to monitor the progress of reaction and to determine the nature of final product. Cubic ZnO₂ transformed to hexagonal ZnO after grinding for 4 h. Band gap of the sample, determined by Kubelka-Munk function, was 3.02 eV. Vibration modes at 509 and 557 cm⁻¹ due to defects were prominent for this sample in its Raman spectrum. This was endorsed by intense emission at 440 nm in the photoluminescence spectrum as well. The reaction of ZnO₂ with Cu powder was slow and completed after grinding for 11 h yielding hexagonal ZnO. Doping of Cu²⁺ for Zn²⁺ in ZnO was confirmed from reduction in the band gap as compared with bulk ZnO. High concentration of defects manifested as emissions at 377, 409 and 419 nm when excited with $\lambda = 320$ nm. Both the samples catalyzed photo degradation of Rhodamine-B (Rh-B) dye solution. The recyclable nature of it has also been examined.

1. Introduction

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