Effects of the duration of ultrasonic irradiation and the atmospheric environment on the characteristics of zno nanostructures via a sonochemical method

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Abstrak

Nanostructured zinc oxide (ZnO) was synthesized via a sonochemical method. The effect of the duration of ultrasonic irradiation in a continuous mode on the generated particles was investigated. Additionally, the effect of flowing either air or nitrogen during the sonication process was investigated. Zinc nitrate and ammonia water-based solutions were selected as chemicals without the addition of other surfactants. The generated particles indicated that a wurtzite structure of ZnO in a hexagonal phase was formed with a crystalline size that increased as the ultrasound irradiation time increased. The morphology of the generated ZnO particles could be changed from flowerlike to needlelike structures via continuous ultrasound irradiation over one to two hours, resulting in increases in the particle lengths and decreases in the particle diameters from 200 to 80 nm. Photoluminescence intensity was also increased with increases in the ultrasonic irradiation times. Photoluminescence spectra were also influenced by the atmospheric environment. Two bands centered at 390 and 500 nm were generated under a nitrogen environment. On the other hand, a single wide band with a peak at around 430 nm was found for particles generated under an air environment. It can be applied for light emitting diodes (LED) or laser fabrication with a controlled emitting band.