Sintesis dan karakterisasi struktur dan sifat optis nanopartikel ZnO didop Co menggunakan metode kopresipitasi = Synthesis and characterization of structure and optical properties Co doped ZnO by Co precipitation method

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Abstrak

ZnO nanopartikel dengan berbagai variasi konsentrasi dopan Co2+ (3, 6, 15 dan 17 at.%) disintesis dengan metode ko-presipitasi. Karakerisasi yang dilakukan meliputi pengukuran EDX, XRD dan UV-VIS untuk mengamati struktur dan sifat optis dari ZnO didop Co nanopartikel. Komposisi Co dalam sample dikatahui dari karakterisasi EDX,. Hasil difraksi sinar X (XRD) menunjukkan bahwa sampel memiliki fase wurtzite dan tidak ditemaknnya fase sekunder. Hasil tersebut membuktikan bahwa ion Co2+ telah berhasil mensubtitusi Zn2+ dalam matrix ZnO. Analisis pelebaran puncak sinar X dilakukan untuk menilai crystalline size dan lattice strain dengan menggunakan metode analisis Williamson-Hall (W-H). Seluruh parameter terkait seperti strain, stress dan nilai energy density turut ditentukan nilainya dengan menggunakan berbagai model dari analisis W-H, yakni uniform deformation model (UDM), uniform stress deformation model (USDM) dan uniform deformation energy density model (UDEDM). Ketiga model analisis tersebut akan menghasilkan nilai strain yang berbeda diakibatkan pendekatan-pendekatan yang dilakukan. Sifat optis seperti celah pita energy dikarakterisasi dengan spektroskopi UV-VIS menunjukan penurunan seiring dengan bertambahnya konsentrasi dopan yang diberikan.
.....ZnO nanoparticles with different Co2+ doping concentrations (3,6,15 and 17 at.%) were synthesized by co-precipitation method. Characterization technique of EDX, XRD and UV-Visible spectra measurement were done to investigate the effects of the doping concentration on the structural and optical properties of Co doped ZnO nanoparticles (NP). The compositional analysis was carried out by Energy Dispersive X-Ray (EDX) measurement. X-Ray diffraction analysis reveals that the Co doped ZnO NP crystallize in wurzite structure without any impurity phase and Co2+ ion were successfully incorporated into the lattice position of Zn2+ ions in ZnO matrix. The wurzite structure (lattice constant) is decreasing with increasing Co doping concentration, it show their crystallization decrease with the increase of Co2+ doping Concentration. The crystalline development in the Co doped ZnO NP was investigated by X-Ray peak broadening. The Williamson-Hall (WH) analysis was used to study the individual contribution of crystallize size and lattice strain on the peak broadening. All other relevant physical parameter such as strain, stress and energy density values were also calculated using W-H plot analysis with different model, viz, uniform deformation model, uniform stress deformation model and uniform deformation energy density model, the three models yield different strain values, it may be due to anisotropic nature or the material. The optical studies show that the band gap of Co doped ZnO NP decreases with increase doping concentration.