ABSTRACT

SYNTHESIS OF COBALT NICKEL FERRITE ($Co_{0.5}Ni_{0.5}Fe_2O_4$) NANOPARTICLES USING CO-PRECIPITATION METHOD AND CHARACTERIZATION OF ITS CRYSTAL STRUCTURES AND MAGNETIC PROPERTIES

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Magnetic nanoparticles of $Co_{0.5}Ni_{0.5}Fe_2O_4$ have been successfully synthesized using co-precipitation method by varying synthesis temperature and NaOH concentration. From the X-ray diffraction (XRD) analysis, it was confirmed that $Co_{0.5}Ni_{0.5}Fe_2O_4$ nanoparticles have spinel cubic structure. We found that the crystallite size is in the range of 7.3 nm - 11.7 nm. The lattice parameter did not change by varying synthesis temperature and NaOH concentration. The maximum magnetization synthesized at 3 M NaOH was 11.3 emu/gram, and it increased to be 12.0 emu/gram as the ferrite phase increases. The coercivity synthesized at 3 M NaOH was 0.1 kOe, and it increased to be 0.2 kOe as the crystallite size increases in single domain. The maximum magnetization synthesized at 30 ^oC was 9.9 emu/gram, and it increased to be 12.3 emu/gram as the crystalinity degrees increases. The coercivity synthesized at 30 ^oC was 0.1 kOe, and it increased to be 0.2 kOe as the crystallite size decreases in multy domain. From the Transmission Electron Microscopy (TEM) image, it was shown agglomerated. From the Fourier Transform Infra-Red (FTIR) spectra, it was confirmed that vibration of octahedral and tetrahedral metal-oxide bond are at 601.83 cm^{-1} and 370.3 cm^{-1}.

Keywords: magnetic nanoparticles, *cobalt nickel ferrite*, co-precipitation, crystal structures, synthesis.

INTISARI

SINTESIS NANOPARTIKEL *COBALT NICKEL FERRITE* ($Co_{0,5}Ni_{0,5}Fe_2O_4$) DENGAN METODE KOPRESIPITASI DAN KARAKTERISASI STRUKTUR KRISTAL DAN SIFAT KEMAGNETANNYA

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Nanopartikel magnetik $Co_{0,5}Ni_{0,5}Fe_2O_4$ berhasil disintesis melalui metode co-presipitasi dengan variasi suhu sintesis dan konsentrasi NaOH. Berdasarkan analisa *X-ray diffraction* (XRD) mengkonfirmasi nanopartikel $Co_{0,5}Ni_{0,5}Fe_2O_4$ memiliki struktur kristal kubus spinel. Ukuran kristalit berkisar antara 7,3 nm - 11,7 nm. Parameter kisi tidak berubah dengan adanya variasi suhu sintesis dan konsentrasi NaOH. Magnetisasi maksimum hasil sintesis dengan NaOH 3 M adalah 11,3 emu/gram, dan meningkat 12,0 emu/gram dengan bertambahnya fasa ferit. Koersivitas hasil sintesis NaOH 3 M adalah 0,1 kOe, kemudian meningkat menjadi 0,2 kOe dengan meningkatnya ukuran kristalit pada singel domain. Magnetisasi maksimum hasil sintesis pada suhu 30 ^oC adalah 9,9 emu/gram dan kemudian meningkat 12,3 emu/gram dengan bertambahnya derajat kristalinitas. Koersivitas hasil sintesis pada 30 ^oC adalah 0,1 kOe meningkat 0,2 kOe dengan penurunan ukuran kristalit pada multi domain. Berdasarkan gambar *Transmission Electron Microscopy* (TEM), menunjukkan bahwa telah mengalami agglomerasi. Berdasar spektrum *Fourier Transform Infra-Red* (FTIR), mendeteksi fibrasi gugus fungsi logam-oksida oktahedral dan tetrahedral berada pada 601,8 cm^{-1} dan 370,3 cm^{-1}.

Kata kunci: nanopartikel magnetik, *cobalt nickel ferrite* , kopresipitasi, struktur kristal, sintesis.