INTISARI

Kajian Efek Konsentrasi NaOH dan Suhu Sintesis terhadap Struktur Kristal dan Sifat Kemagnetan Nanopartikel *Cobalt Zinc Ferrite* ($Co_{0,5}Zn_{0,5}Fe_2O_4$)

oleh

Amjad Tri Puspitasari
16/403546/PPA/05063

Nanopartikel $Co_{0,5}Zn_{0,5}Fe_2O_4$ telah berhasil disintesis melalui metode kopresipitasi dengan memvariasikan konsentrasi NaOH dari 1,5 M hingga 12 M dan suhu sintesis dari 30°C hingga 90°C.Analisis *X-ray diffraction* (XRD) mengkonfirmasi bahwa nanopartikel $Co_{0,5}Zn_{0,5}Fe_2O_4$ mempunyai struktur kristal spinel kubik dengan ukuran kristalit yang berkisar antara 7,9 hingga 21,4 nm. Ukuran kristalit relatif meningkat dengan peningkatan konsentrasi NaOH dan suhu sintesis yang berkaitan dengan mekanisme nukleasi dan pertumbuhan kristal nanopartikel selama proses sintesis. Gambar *Transmission Electron Microscope* (TEM) menunjukkan bahwa sampel mengalami aglomerasi. Gambar *Selected Area Electron Diffraction* (SAED) menunjukkan cincin difraksi yang merepresentasikan bidang miller dan mengkonfirmasi bahwa nanopartikel merupakan polikristalin. Pengukuran kemagnetan dengan menggunakan *Vibrating Sample Magnetometer* (VSM) mengindikasikan bahwa nanopartikel $Co_{0,5}Zn_{0,5}Fe_2O_4$ menunjukkan sifat ferimagnetik dan cenderung menjadi superparamagnetik dengan berkurangnya ukuran kristalit. Peningkatan nilai koersivitas dan magnetisasi saturasi juga ditemukan pada peningkatan konsentrasi NaOH dan suhu sintesis. Hal ini disebabkan oleh adanya *single domain* dan peningkatan derajat kristalinitas. Koersivitas tertinggi sebesar 545,6 Oe ditemukan pada sampel dengan konsentrasi NaOH 12 M pada suhu 70°C. Magnetisasi saturasi tertinggi sebesar 29,2 emu/gram ditemukan pada sampel dengan konsentrasi NaOH 6 M pada suhu 90°C yang disebabkan oleh peningkatan derajat kristalinitas sampel. Spektrum *Fourier Transform Infrared Spectroscope* (FTIR) juga mengkomfirmasi adanya pita vibrasi *stretching* pada ion logam di sekitar 563-609 cm^{-1} and 316-493 cm^{-1} berturut-turut dalam ruang tetrahedral dan oktahedral.

ABSTRACT

Study of NaOH concentration and Temperature Synthesis Effect on Crystal Structure and Magnetic Properties of Cobalt Zinc Ferrite ($Co_{0.5}Zn_{0.5}Fe_2O_4$) Nanoparticles

by

Amjad Tri Puspitasari
16/403546/PPA/05063

$Co_{0.5}Zn_{0.5}Fe_2O_4$ nanoparticles have been successfully synthesized by coprecipitation method with varying NaOH concentrations from 1.5 M to 12 M and synthesis temperatures from 30°C to 90°C. X-ray diffraction (XRD) analysis confirmed that $Co_{0.5}Zn_{0.5}Fe_2O_4$ nanoparticles have spinel cubic crystal structure with crystallite size ranging from 7.9 to 21.4 nm. The crystallite size increase relatively by increasing NaOH concentration and synthesis temperature which related to the nucleation and crystal growth mechanism of nanoparticles during synthesis.The transmission electron microscope (TEM) image showed that the sample was aglomerated. The selected area electron diffraction (SAED) image showed the diffraction ring as representation of miller plane and confirmed that nanoparticles was polycrystalline. Magnetic measurement by Vibrating Sample Magnetometer (VSM) indicated that $Co_{0.5}Zn_{0.5}Fe_2O_4$ nanoparticles shows ferimagnetic behaviour and tend to be superparamagnetic with decreasing crystallite size. The increase in coercivity and saturation magnetization also have been found by increasing NaOH concentration and synthesis temperature. It is attributed to single domain existence and an increasing of crystallinity degree. The highest coersivity of 545.6 Oe was attained for sample of 12 M NaOH under 70°C. The highest magnetization of 29.2 emu/gr was attained from sample of 6 M NaOH under 90°C caused by increasing of crystallinity degree of sample. The Fourier transform infrared spectroscope (FTIR) spectra also confirmed the existence of symmetric stretching vibration bands of metal ions near 563-609 cm^{-1} and 316-493 cm^{-1} in tetrahedral and octahedral sites, respectively