

INTISARI

**Pengaruh Suhu *Annealing*
Terhadap Mikrostruktural, Sifat Kemagnetan dan Celah Energi
Nanopartikel Ni_{0,5}Zn_{0,5}Fe₂O₄ yang Disintesis dengan Metode Kopresipitasi**

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Nanopartikel Ni_{0,5}Zn_{0,5}Fe₂O₄ telah berhasil disintesis dengan metode kopresipitasi. Sampel yang telah disiapkan di-*annealing* dengan variasi suhu yaitu 200 °C, 400 °C, 600 °C, 800 °C dan 1000 °C. Terbentuknya struktur fasa spinel campuran sampel nanopartikel telah dikonfirmasi melalui pola *X-Ray Diffraction* (XRD) dengan ukuran kristalit 14,8 nm hingga 25,1 nm. Peningkatan ukuran kristalit dikarenakan terjadinya pertumbuhan butir nanopartikel akibat adanya perlakuan panas. Mikrograf dari *Transmission Electron Microscope* (TEM) menunjukkan bahwa sampel *annealing* lebih terdispersi dan batas butir lebih terlihat jelas dibandingkan dengan sampel sebelum *annealing*. Pola citra dari *Selected Area of Electron Diffraction* (SAED) mengkonfirmasi terbentuknya nanopartikel polikristalin pada sampel. Spektrogram *Fourier Transform Infra-Red* (FTIR) menunjukkan adanya vibrasi regangan antar ion-ion pada frekuensi 378,05 cm⁻¹ dan 555,50 cm⁻¹ yang dikonfirmasi sebagai daerah oktahedral dan tetrahedral, masing-masingnya. Kurva histeresis menegaskan bahwa sampel memiliki sifat *soft magnetic* dengan koersivitas (*H_c*) meningkat seiring dengan meningkatnya suhu *annealing* di kisaran 45,4 - 94,1 Oe. Magnetisasi maksimum spesifik (σ_s) sampel sebelum *annealing* adalah 12,8 emu/gr dan kemudian meningkat hingga 57,2 emu/gr pada sampel *annealing* 1000 °C. Nilai celah energi sampel nanopartikel Ni_{0,5}Zn_{0,5}Fe₂O₄ yaitu 2,2 eV dan turun menjadi 1,9 eV setelah di-*annealing* pada suhu 1000 °C.

Kata Kunci: *Nickel Zink Ferrite* (Ni_{0,5}Zn_{0,5}Fe₂O₄), suhu *annealing*, mikrostruktural, magnetik, celah energi

ABSTRACT

Effects of Annealing Temperature on Microstructural, Magnetic Properties and Energy Gap of Ni_{0,5}Zn_{0,5}Fe₂O₄ Nanoparticles Synthesized By Co-Precipitation Method

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The Ni_{0,5}Zn_{0,5}Fe₂O₄ nanoparticles have been successfully synthesized by coprecipitation method. The prepared sample was annealed with various temperatures i.e., 200 °C, 400 °C, 600 °C, 800 °C and 1000 °C. The formation of mixed spinel phase structure of nanoparticles sample was confirmed by using X-Ray Diffractometer (XRD) pattern which crystallite size is in range of 14,8 nm to 25,1 nm. The increase of crystallite size is due to grain growth of nanoparticles because of thermal treatment. The Transmission Electron Microscope (TEM) micrograph showed that the annealed sample exhibited better dispersion and grain boundary was well developed compared than the as-prepared sample. The Selected Area of Electron Diffraction (SAED) image confirmed the formation of polycrystalline nanoparticles. The Fourier Transform Infra-Red (FTIR) spectra showed the existence of stretching vibration bands of metal ions around frequency of 378,05 cm⁻¹ and 555,50 cm⁻¹ which are confirmed as octahedral and tetrahedral sites, respectively. The hysteresis loops confirmed that the sample possess soft magnetic properties with coercivity (*H_c*) increase by increasing annealing temperature in the range of 45,4 – 94,1 Oe. The specific maximum magnetization (σ_s) at 15 kOe of the as-prepared sample were 12,8 emu/gr and then increase to about 57,2 emu/gr for samples annealed at 1000 °C. The values of an optical band gap of Ni_{0,5}Zn_{0,5}Fe₂O₄ were found 2,2 eV and decrease to 1,9 eV after annealing with 1000 °C.

Keywords: Nickel Zink Ferrite (Ni_{0,5}Zn_{0,5}Fe₂O₄), annealing temperature, microstructural, magnetic, energy gap