

INTISARI

Kajian Struktur Kristal dan Sifat Magnetik Nanopartikel *Multiferroic Bismuth Ferrite*

Oleh

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Nanopartikel *multiferroic Bismuth ferrite* telah berhasil disintesis melalui metode kopresipitasi dengan variasi parameter sintesis meliputi konsentrasi NaOH (4, 6, 8, dan 10 M), suhu sintesis (RT, 60, 80, 100, dan 105 °C), suhu annealing (400 dan 600 °C), serta durasi pengadukan (60, 120, 180, dan 240 menit). Analisa *x-ray diffraction* (XRD) mengonfirmasi fase struktur kristal nanopartikel berupa $\text{Bi}(\text{OH})_3$, $\text{Bi}_{25}\text{FeO}_{40}$, dan Bi_{ns} . Citra morfologi dari *transmission electron microscope* (TEM) menunjukkan bahwa nanopartikel teraglomerasi, serta memiliki bentuk dan ukuran butiran yang tidak seragam. Spektrum *fourier transform infra-red* (FTIR) pada $400\text{-}700\text{ cm}^{-1}$ mengindikasikan adanya vibrasi Bi-O dan Fe-O. Analisa kurva histeresis magnetisasi pada pengukuran *vibrating sample magnetometer* (VSM) mendemonstrasikan sifat anti-ferromagnetik dan ferromagnetik pada variasi suhu sintesis dan suhu annealing, sementara variasi konsentrasi NaOH dan durasi pengadukan tidak memberikan pengaruh yang signifikan terhadap sifat magnetik nanopartikel.

Kata kunci: *multiferroic Bismuth ferrite*, kopresipitasi, parameter sintesis, struktur kristal, sifat magnetik

ABSTRACT

Study of Crystal Structure and Magnetic Properties of Multiferroic Bismuth Ferrite Nanoparticles

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Multiferroic Bismuth ferrite nanoparticles have been successfully synthesized by coprecipitation method with varying the synthesis parameter as NaOH concentrations (4, 6, 8, and 10 M), synthesis temperature (RT, 60, 80, 100, and 105 °C), annealing temperature (400 and 600 °C), and stirring duration (60, 120, 180 and 240 minutes). X-ray diffraction (XRD) analysis confirmed the nanoparticles crystal structure phase in the form of $\text{Bi}(\text{OH})_3$, $\text{Bi}_{25}\text{FeO}_{40}$, and Bi_{ns} . The morphological image of the transmission electron microscope (TEM) shows that the nanoparticles were agglomerated, while the grains have non-uniform shape and size. Fourier transform infra-red (FTIR) spectrum at $400\text{-}700\text{ cm}^{-1}$ indicates the presence of Bi-O and Fe-O vibrations. Analysis of magnetization hysteresis loop on the vibrating sample magnetometer (VSM) measurements demonstrated the antiferromagnetic and ferromagnetic properties by the synthesis and annealing temperature variation, while increasing NaOH concentration and stirring duration did not have a significant effect on the magnetic properties of nanoparticles.

Keywords: multiferroic Bismuth ferrite, coprecipitation, synthesis parameter, crystal structure, magnetic properties