Sifat magnetik dan listrik lapisan Ni80CoxFe20-x (x = 0, 5, 10, 15, dan 20) yang disintesis dengan metode elektrodeposisi = Magnetic and electrical properties of Ni80CoxFe20-x (x=0, 5, 10, 15, and 20) films synthesized by flectrodeposition method

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Abstrak

Material lapisan Ni80CoxFe20-x (x = 0, 5, 10, 15, dan 20) disintesis dengan metode elektrodeposisi pada substrat ITO-PET. Struktur kristal, fasa material, sifat magnetik dan perubahan resistivitas akibat pengaruh komposisi Ni80CoxFe20-x diteliti melalui karakterisasi X-Ray Diffractometer (XRD), Scanning Electron Microscope (SEM), Energy Dispersive Spectroscopy (EDS)-Mapping, Vibrating Sample Magnetometer (VSM), dan metode Four-Point Probe pada Cryogenic Magnetometer (Oxford Teslatron Instrument). Hasil XRD menunjukkan struktur kristal FCC dengan space group Fm3m. Komposisi dari seluruh sampel mencapai komposisi target (dengan toleransi ±5) dan homogenitas yang baik melalui karakterisasi EDS-Mapping dan SEM. Hasil VSM menunjukkan seluruh sampel merupakan material soft feromagnetik pada suhu ruang. Seluruh sampel berhasil menghasilkan lapisan dengan saturasi magnetisasi >80 emu/gram dan nilai koersivitas <250 Oe. Kelima sampel memiliki rentang saturasi magnetisasi dari 90,387-159,792 emu/g dan koersivitas dari 95,84-191,33 Oe di mana saturasi magnetisasi tertinggi terjadi pada komposisi Ni80Co10Fe10 sedangkan koersivitas terendah terjadi pada komposisi Ni80Co15Fe5. Pengujian nilai resistivitas listrik terhadap perubahan temperatur (5-300 K) menunjukkan bahwa seluruh sampel bersifat konduktor dikarenakan nilai resistivitasnya meningkat seiring dengan meningkatnya temperatur. Hasil penelitian ini menunjukkan bahwa komposisi suatu material memengaruhi sifat magnetik dan nilai resistivitasnya. Komposisi lapisan Ni80CoxFe20-x (x = 0, 5, 10, 15, dan 20) yang memiliki fasa tunggal, lapisan yang homogen, komposisi yang mencapai target, bersifat soft magnetic dengan koersivitas rendah (<250 Oe) dan saturasi magnetisasi yang tinggi (>80 emu/gram) serta perubahan resistivitas yang kecil terhadap temperatur adalah x = 15, yaitu Ni80Co15Fe5.

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Films of Ni80CoxFe20-x (x = 0, 5, 10, 15, and 20) was synthesized by electrodeposition method on ITO-PET substrate. The crystal structure, material phase, magnetic properties and change of resistivity as a result of composition changes on Ni80CoxFe20-x was characterized by X-Ray Diffractometer (XRD), Scanning Electron Microscope (SEM), Energy Dispersive Spectroscopy (EDS)-Mapping, Vibrating Sample Magnetometer (VSM), and Four-Point Probe Method using Cryogenic Magnetometer (Oxford Teslatron Instrument). XRD results show FCC crystal structure with the Fm3m space group. The composition of all samples was successfully close to the target composition (with ±5 tolerance) and even homogeneity through EDS-Mapping and SEM. VSM results show that all samples are soft ferromagnetic in room temperature. All samples successfully achieve saturation of magnetization >80 emu/gram and coercivities <250 Oe. All samples resulted with saturation of magnetization ranging from 90,387-159,792 emu/g and coercivity ranging from 95,84-191,33 Oe where the highest saturation of magnetization was found at the composition of Ni80Co10Fe10 while the lowest coercivity was found at the composition of Ni80Co15Fe5. Characterization of resistivity values under the influence of temperature change (5-300 K) shows that all

samples are conductors because of the increase of resistivity values when temperature is increased. The result of this experiment shows that the composition of a material affects the magnetic properties and resistivity value. The composition of Ni80CoxFe20-x (x = 0, 5, 10, 15, dan 20) films that has a single phase, uniform film, composition that reaches the target, is soft magnetic with low coercevities (<250 Oe) and high saturation of magnetization (>80 emu/gram), and low resistivity value change under the influence of increased temperature is x = 15, that is Ni80Co15Fe5.