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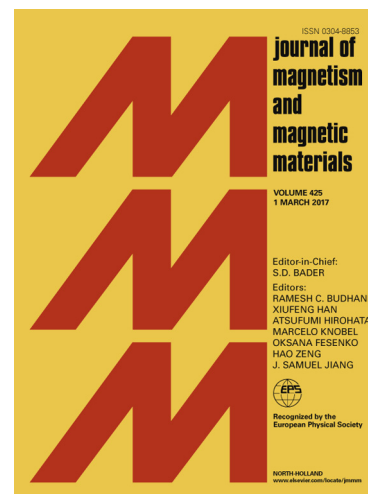
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Synthesis of nanocrystalline equiatomic nickel-cobalt-iron alloy powders by mechanical alloying and their structural and magnetic characterization

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Abstract

Mechanically alloying equiatomic Ni, Co, and Fe powder blends for 9 h resulted in the formation of nanocrystalline equiatomic NiCoFe alloy powders comprised of γ -phase. The crystallite size and the lattice parameter was $\sim 20 \pm 5$ nm and 0.3597 ± 0.0005 nm, respectively. The mode of the powders was 3-7 μ m. The saturation magnetization (M_s) and the intrinsic coercivity (H_{CI}) of the alloy, at 300 K, was $\sim 136 \pm 5$ Am²/kg and $\sim 2.0 \pm 0.2$ kA/m, respectively. Both M_s and H_{CI} , irrespective of the milling media and milling atmosphere, decreased with increase in temperature from 60 K to 300 K. At elevated temperatures (400 K to 880 K), the alloy powders maintained the γ -phase up to 640 K, thereafter it was comprised of γ -phase and α -Fe. In the temperature regime 300-640 K, the percentage decrease in M_s and H_{CI} was $\sim 12\%$ and $\sim 30\%$, respectively. The M_s and H_{CI} at 300 K, after the magnetization versus applied magnetic field (M - H) run at 640 K, was ~ 136 Am²/kg and ~ 1.5 kA/m, respectively; while the same after the M - H run at 880 K was ~ 154 Am²/kg and ~ 1.0 kA/m, respectively. Annealing of the nanocrystalline alloy powders is likely to improve its soft-magnetic properties.

Keywords: nanocrystalline equiatomic NiCoFe alloy, mechanical alloying, lattice parameter, saturation magnetization, and intrinsic coercivity

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