The Effect of Si Contenent on the Physical Properties of Nanostructured (Ni75Fe25)100-xSix Alloy Elaborated by Mechanical Alloying

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Abstract:

We evaluate the effects of Si content on the physical properties of nanostructured (Ni0.75Fe0.25)100-X SiX (x = 0, 3.5, 6.5, 9, 12, and 15 at. %) powders fabricated by mechanical alloying for a milling time of 96 h. The microstructures and hyperfine and magnetic properties of the powders were investigated as a function of the Si content by X-ray diffraction (XRD), scanning electron microscopy (SEM), and vibrating-sample magnetometry. The XRD patterns showed formation of a face-centred cubic disordered Ni (Fe, Si) solid solution after 96 h. As the Si content increases, the lattice parameter and grain size decrease (from ~28 to 15 nm), while the microstrain level decreases from 0.98% to 0.65%. SEM images showed that the powder particles became round and their sizes decreased with the increase in Si content. From the hysteresis curves, we extracted the values of the saturation magnetisation and coercive field for all powders. The evolutions of Ms and Hc as a function of the Si content are discussed.

Keywords:

Nanostructured powders, Nanocrystalline, Magnetic materials, (Ni0.75Fe0.25)100-X SiX, Microstructure.