X-ray diffraction and Mössbauer studies of nanostructured ball milled Fe$_{50}$Co$_{40}$Ni$_{10}$

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Abstract:

The ball milling of blended iron, cobalt and nickel powders was carried out in a high-energy planetary mill, under argon atmosphere, in order to obtain a nanostructured Fe$_{50}$Co$_{40}$Ni$_{10}$ alloy. Morphological, microstructural and structural changes at different stages of milling were investigated by scanning electron microscopy and X-ray diffraction using a refinement program of the peak diffraction profiles based on the Rietveld method. The hyperfine structure and the alloying of the elemental powders, at the atomic level, were studied by $^{57}$Fe Mössbauer spectrometry. X-ray diffraction investigations show that the Fe$_{50}$Co$_{40}$Ni$_{10}$ alloy obtained during milling process is in nanocrystalline state. Disordered Fe-Co based solid solution with bcc lattice was formed with a low value of the crystallite size and a high degree of microstrains and dislocation density. Mössbauer spectrometry reveals the hyperfine magnetic fields distributions which reflect the different surroundings of $^{57}$Fe isotopes by Co, Fe and Ni atoms.