Abstract
In the present work, nanocrystalline (Fe70Al30)100-xSix (x=0, 5, 10, 15 and 20 at.%) powders were prepared by mechanical alloying for a fixed milling time of 72 h. The powder samples were characterized in terms of structural evolution, morphological changes and magnetic behavior. The X-ray diffraction measurements reveal that all the samples are of (bcc) single phase with an average crystallite size less than 22 nm. Besides, the lattice parameter decreases with Si content (x) up to the solubility limit of Si atoms into the α-Fe lattice where it remains independent of the composition. The magnetic data obtained by Vibrating Sample Magnetometer showed that the saturation magnetization decreases monotonously with Si content increasing x, whereas coercivity which not only depends on composition but also on structure of the sample decreases to a minimum of 20.3 Oe at x= 10 at.% and increases abruptly at the higher x value (x= 20 at.%). Mössbauer spectroscopy analyses indicated that the sample with x= 5 at.% exhibits a fully ferromagnetic behavior and that beyond this concentration, the content of the ferromagnetic phase gradually decreases due to the non magnetic nature of Si.