

Fe-Co alloy powders prepared by mechanical milling: The effect of milling time and annealing temperature on the structural and magnetic properties

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Nanosized Fe-Co alloy powders were prepared by high-energy mechanical ball milling in air with different times, and then annealed at different temperatures. The structural and magnetic characteristics of the powders were studied in detail by using X-ray diffraction (XRD), X-ray absorption spectroscopy (XAS) techniques, and a field-emission scanning electron microscope (FE-SEM), a vibrating sample magnetometer (VSM), and a physical property measurement system (PPMS). XRD analyses pointed out the evolution of the bcc phase of Fe-Co alloy and a secondary phase of Fe₃O₄. Meanwhile, XAS spectra data clearly showed the oxidation state of +0 as well as ratio of bcc and hcp phases of the alloyed Fe-Co samples. We showed that the temperature dependence of the saturation magnetization of the samples after annealing could be well described by Bloch's law. Besides, we also observed an upward tendency of coercivity with the annealing temperatures or the grain size. Finally, the effect of the oxidation on the magnetic properties and magnetization stability of the samples will be discussed.