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Structural, magnetic and mechanical properties of hydrous Fe/Ni –based oxide components nanoparticles synthesized by radiolytic method

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Abstract

Hydrous Fe/Ni-based oxide components nanoparticles in core/shell structure were successfully synthesized by radiolytic reduction method. Structural analysis confirmed the formation of double-layered nanoparticles with iron oxide core, which are more easily reducible by gamma radiation rather than Ni ions, and (Fe, Ni)OOH shell at lower irradiation dose. At high irradiation doses, the formation of triple-layered nanoparticles with the core of iron oxide and the outer shell of nickel/nickel oxide and middle layer made of hydroxide of both kinds of metals were observed. The modification of core, shell and middle layer effectively influence on final structure which consequently affect on the magnetic and mechanical properties of the final products. By increasing radiation dose, the phase transition between super-paramagnetic to ferromagnetic has been observed. Moreover, the stiffness value increased by irradiation dose increasing. The phase transition can be explained by variation of Ni content at the surface of iron oxide core, while the increase in the stiffness of the final product is mainly due to the increasing in Ni content of final products.

Keywords: Fe/Ni-based oxide; Gamma radiation; Core/shell; Nanostructure

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