Annealing study of α-Fe2O3 nanoparticles steel-waste based: microstructure and magnetic behavior

ABSTRACT

The interest of this paper is to show the influence of annealing process on magnetic properties and microstructure of □-Fe2O3 derived from steel waste product (mill scales). The mill scales flakes were wet ball milling for several hours to form a fine powder. The mill scales powder was purified by using magnetic separation to isolate the magnetic and non magnetic particles. The method was continue for Curie temperature separation technique. The purified powder was annealed at 400/450/500 and 550 °C at 6 oC/mins to form hematite, □-Fe2O3. The annealed powders were milled for several hours by using mechanical alloying. Annealing at varied temperatures produced α-Fe2O3 nanopowders with average crystallite size 18.1 nm to 28.6 nm. Phase transformation occurred directly by annealing in air, conversion of FeO and Fe3O4 phase to form α-Fe2O3. The correlation between the magnetic properties and microstructure, of the sintered powders at 1200 oC enables to obtain microphase of α-Fe2O3 and Fe3O4 with different particle size and magnetic properties. The resultant α-Fe2O3 nanopowders are ferromagnetic with moderate coercivities.

Keyword: Fe2O3; Steel waste; Particle size; Magnetic properties; Mechanical alloying