

Magnetic and structural properties of FINEMET nano powder fabricated by Mechanical Milling Method

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An Fe_{73.5}Si_{13.5}B₉Nb₃Cu₁ alloy, known as FINEMET, is an attractive soft magnetic material, which finds use in electric power applications such as transformer cores and other inductive devices. It exhibits excellent permeability (~ 105 at 1 kHz), a low saturation magnetostriction ($\sim 2 \times 10^{-6}$) and a relatively high saturation magnetization (~ 1.2 T).

The magnetic and structural properties of FINEMET nano powder with a composition of Fe_{73.5}Si_{13.5}B₉Nb₃Cu₁ in wt% were investigated after annealing, chemical etching and mechanical milling. The primary and secondary crystallization temperatures and crystalline peaks are 523 °C and 550 °C, respectively. The grain size of particles was adjusted by annealing time. Optimally annealed particles exhibited a homogenous microstructure composed of nanometer-sized crystalline grains. The grain boundary of annealed particles was etched preferentially by chemical etching method. Chemically etched particles were broken at grain boundary by high-energetic ball milling method. As a result, nanometer-sized FINEMET powder with a same size of crystalline grains was fabricated.