

X-ray diffraction studies on crystallite size evolution of CoFe₂O₄ nanoparticles prepared using mechanical alloying and sintering.

ABSTRACT

Nanosized cobalt ferrite spinel particles have been prepared by using mechanically alloyed nanoparticles. The effects of various preparation parameters on the crystallite size of cobalt ferrite which includes milling time; ball-to powder weight ratio (BPR) and sintering temperature, were studied using X-ray diffractometer (XRD). Scherrer's equation was used to study the crystallite size evolution of the as-prepared materials. The results of the as-milled sample revealed that both milling time and BPR plays a role in determining the crystallite size of the milled powder. However, where sintering is involved, the sintering temperature results in grain growth, and thus plays a dominant role in determining the final crystallite size of the samples sintered at higher temperature (above 900 °C). From the vibrating-sample magnetometer (VSM) measurement it was observed that the coercivity of the as-milled samples without sintering is almost negligible, which is a type characteristic of superparamagnetic material. However, for the sintered samples, the saturation increases while coercivity decreases with increases sintering temperature.

Keyword: Crystallite size; Sintering temperature; X-ray diffraction; Nanoparticles.