

Rietveld's analysis of zinc ferrite prepared by hydrothermal and Sol-gel method

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The effects of difference method on the magnetic properties of ZnFe_2O_4 nanocrystalline have been studied. ZnFe_2O_4 nanoparticles were prepared using both a hydrothermal method at 200°C and a sol-gel method followed by annealing at 550°C . Products from both preparation processes were confirmed by XRD as single phase with a spinel structure. The size of the nanoparticles prepared by sol-gel sample is a little bit larger than that of hydrothermal sample, presumably due to the much higher annealing temperature used during the annealing process. The saturation magnetizations at 1 Tesla measured by the $M-H$ curve at room temperature were 34.37 emu/g and 3.31 emu/g for zinc ferrite prepared by hydrothermal and sol-gel method, respectively. By comparing the integration intensity for peaks (220) and (222) and analyzing the XRD spectra by Rietveld refinement, we show the much enhanced magnetization in hydrothermal ZnFe_2O_4 nanoparticles can be attributed to the cation inversion caused by the inverse filling of Zn cations at the octahedral site and Fe cations at the tetrahedral sites. The result of Rietveld refinement analysis show that the hydrothermal sample actually possess a mixed spinel structure, whereas the sol-gel sample is very close to the normal spinel structure.

Keywords: Nanocrystalline, hydrothermal, sol-gel method, Rietveld refinement, mixed spinel