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X-ray Absorption Investigation on Cation Distribution and Magnetic Behavior of Zinc Ferrite Nanoparticles

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Zinc Ferrite (ZnFe_2O_4) nanopowders were synthesized by ball-milling technique at different milling times (0 to 24 h) starting from as-combusted powders. The XRD and SEM results ensure significant decrease in particle size of these ferrites with increasing processing time. The distribution of cations including zinc (Zn^{2+}) and ferric (Fe^{3+}) ions was investigated by Zn and Fe K-edge X-ray absorption near-edge structure (XANES) and extended X-ray absorption fine structure (EXAFS) spectra. Comparing to after-calcined zinc ferrite, both XANES and EXAFS spectra of milled-zinc ferrite powders obviously indicate the translocation of Zn^{2+} ions from the tetrahedral (A) sites to the octahedral (B) sites and the reverse translocation of some of Fe^{3+} ions without affecting the long-range structural order. Moreover, the analysis of Zn and Fe K-edge EXAFS spectra exhibit obviously increasing degree of inversion as the particle size decreases resulting in the difference in the magnetic properties of the powders.

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