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# The studies of crystal and magnetic structures of complex granulated ferrites by neutron diffraction method

A study of the crystal and magnetic structure of materials based on iron oxides with a structural type of spinel, as a function of doping, temperature or high pressures application, is one of the most urgent problems of modern condensed matter physics. These materials possess a wide range of physical properties such as magnetism, structural phase transitions and giant magnetoresistance. These materials are widely used in various fields of modern industry.
The main aim of the present work is study crystal and magnetic structures of the spinel ferrites: Mn0.25Cu0.75Fe1.7Ga0.3O4, Mn0.5Cu0.5Fe1.7Ga0.3O4, Ni0.4Cu0.4Zn0.2Fe2O4, Ni1.2Zn0.1Ti0.3Fe1.4O4 by a means of the neutron diffraction method. Also, the structural and magnetic properties as a function of granules sizes of spinel ferrites Mn0.676Zn0.224Fe2O4 and Ni0.32Zn0.68Fe2O4 have been studied. Neutron diffraction experiments at room temperature were carried out using the DN-6 and DN-12 diffractometers at the high-flux pulsed reactor IBR-2 (FLNP, JINR, Dubna). Diffraction patterns were obtained using a time-of-flight technique at a fixed scattering angle 2⊠ = 90°. Analysis of diffraction data were performed by the Rietveld method by FullProf program.
The lattice parameters of the studied compounds, the interatomic bonds lengths and valence angles, and the distribution of cations in crystallographic positions A and B in the crystal structure of ferrites have been obtained. The magnetic moments of iron and doping magnetic impurities at different positions of the spinel structure were calculated. It found that magnetic manganese ions distributed between two crystallographic sites. It assumed that for small granules the structural defects in the oxygen sublattice have a noticeable effect on the magnetic properties of studied materials. With an increase in the granules size, a change in the dominant effect from defects related to the effect of the redistribution of magnetic cations between different crystallographic positions in the cubic structure of ferrites is occur. Ferrites with the largest granule size are characterized by the maximum magnetic moments in both crystallographic positions.

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