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Evolution of crystal structure of KFeO2 nanoparticles at aging

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KFeO2 magnetic nanoparticles, which are biocompatible and have a relatively high saturation magnetization are considered as promising heat mediators for magnetic hyperthermia applications. In this work, we study aging effects in KFeO2 nanoparticles and show that they change their structural characteristics over time. As-produced KFeO2 nanoparticles synthesized by sol-gel technique have been aged in the ambient atmosphere for 10,000 h. Aging effect was studied by X-ray diffraction methods. Crystal structure of nanoparticles undergoes essential changes, including an increase of lattice parameter and average coherent block size, and decrease of the microdeformation of crystal lattice. The diffraction pattern of aged KFeO2 sample generally reproduces the Fe3O4 diffraction spectrum and is indexed well in a cubic crystal lattice with a = 0.8337(2) nm. Parameters of real structure have also estimated.

A modeling the possible placement of potassium atoms in the lattice of the oxide studied has revealed that non-equivalent iron atoms in the Fe2.5K0.3O4 and Fe3O4 structures have octahedral FeO6 environment of oxygen atoms, while the potassium atom, which is located at certain positions of the iron atoms in magnetite structure, inherits its setting of oxygen atoms, namely, KO6 with K–O interatomic distances equal to 0.2101 nm.

Topics

Session A. Physics of condensed matter and spectroscopy

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