

Mechanism of Dual Ferroic Properties Formation in Substituted M-Type Hexaferrites

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Abstract : It has been shown that $\text{BaFe}_{12}\text{O}_{19}$ is a perspective room-temperature multiferroic material. A large spontaneous polarization was observed for the $\text{BaFe}_{12}\text{O}_{19}$ ceramics revealing a clear ferroelectric hysteresis loop. The maximum polarization was estimated to be approximately $11.8 \mu\text{C}/\text{cm}^2$. The FeO_6 octahedron in its perovskite-like hexagonal unit cell and the shift of Fe^{3+} off the center of octahedron are suggested to be the origin of the polarization in $\text{BaFe}_{12}\text{O}_{19}$. The magnetic field induced electric polarization has been also observed in the doped $\text{BaFe}_{12-x}\delta\text{Sc}_x\text{M}\delta\text{O}_{19}$ ($\delta=0.05$) at 10 K and in the $\text{BaSc}_x\text{Fe}_{12-x}\text{O}_{19}$ and $\text{SrSc}_x\text{Fe}_{12-x}\text{O}_{19}$ ($x = 1.3\text{--}1.7$) M-type hexaferrites. The investigated $\text{BaFe}_{12-x}\text{D}_x\text{O}_{19}$ ($x=0.1$, D-Al^{3+} , In^{3+}) samples have been obtained by two-step "topotactic" reactions. The powder neutron investigations of the samples were performed by neutron time of flight method at High Resolution Fourier Diffractometer.

Keywords : substituted hexaferrites, ferrimagnetics, ferroelectrics, neutron powder diffraction, crystal and magnetic structures

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