Influence of pressure on the anisotropy of the properties of a nanocomposite with Fe^{3+} iron

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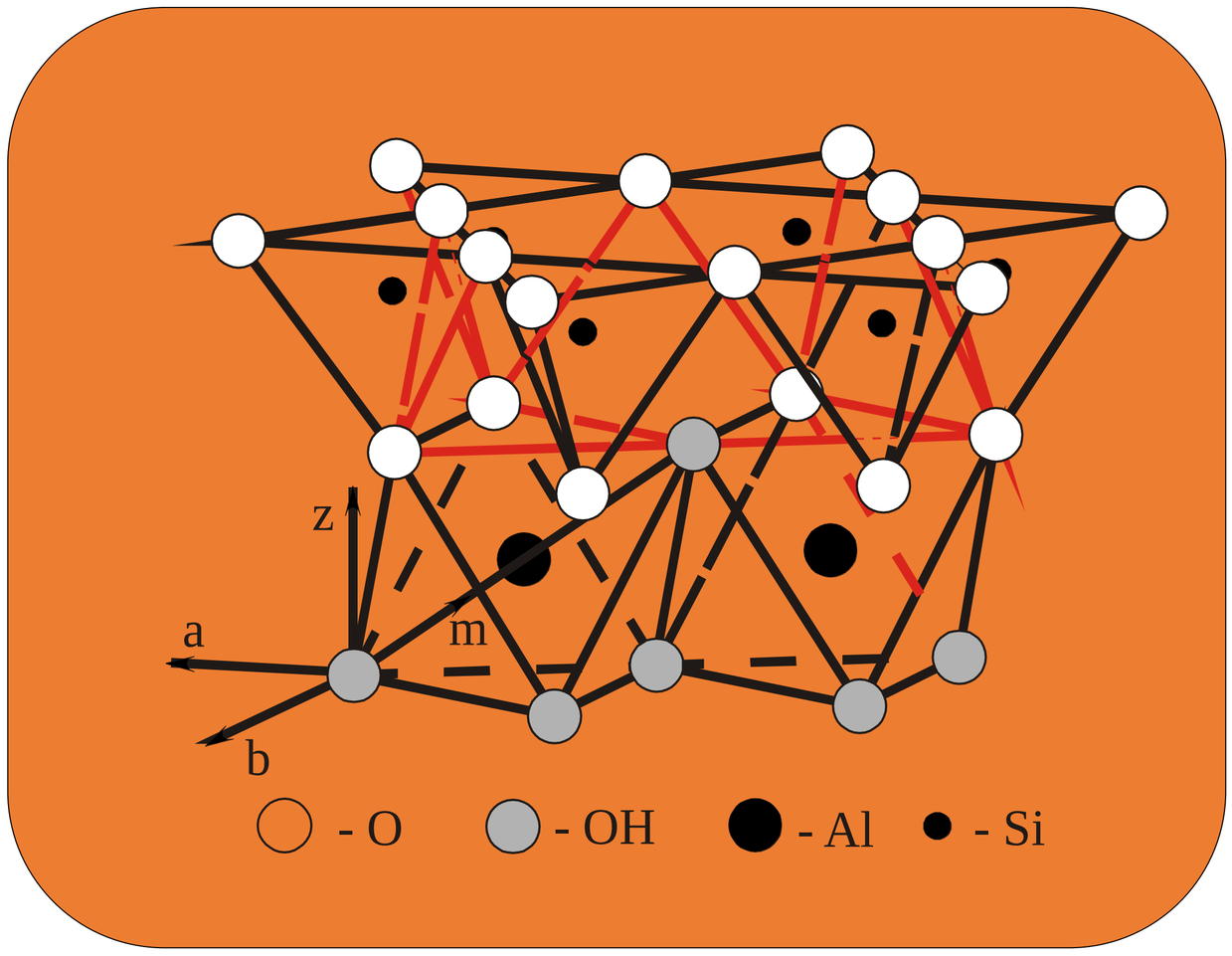
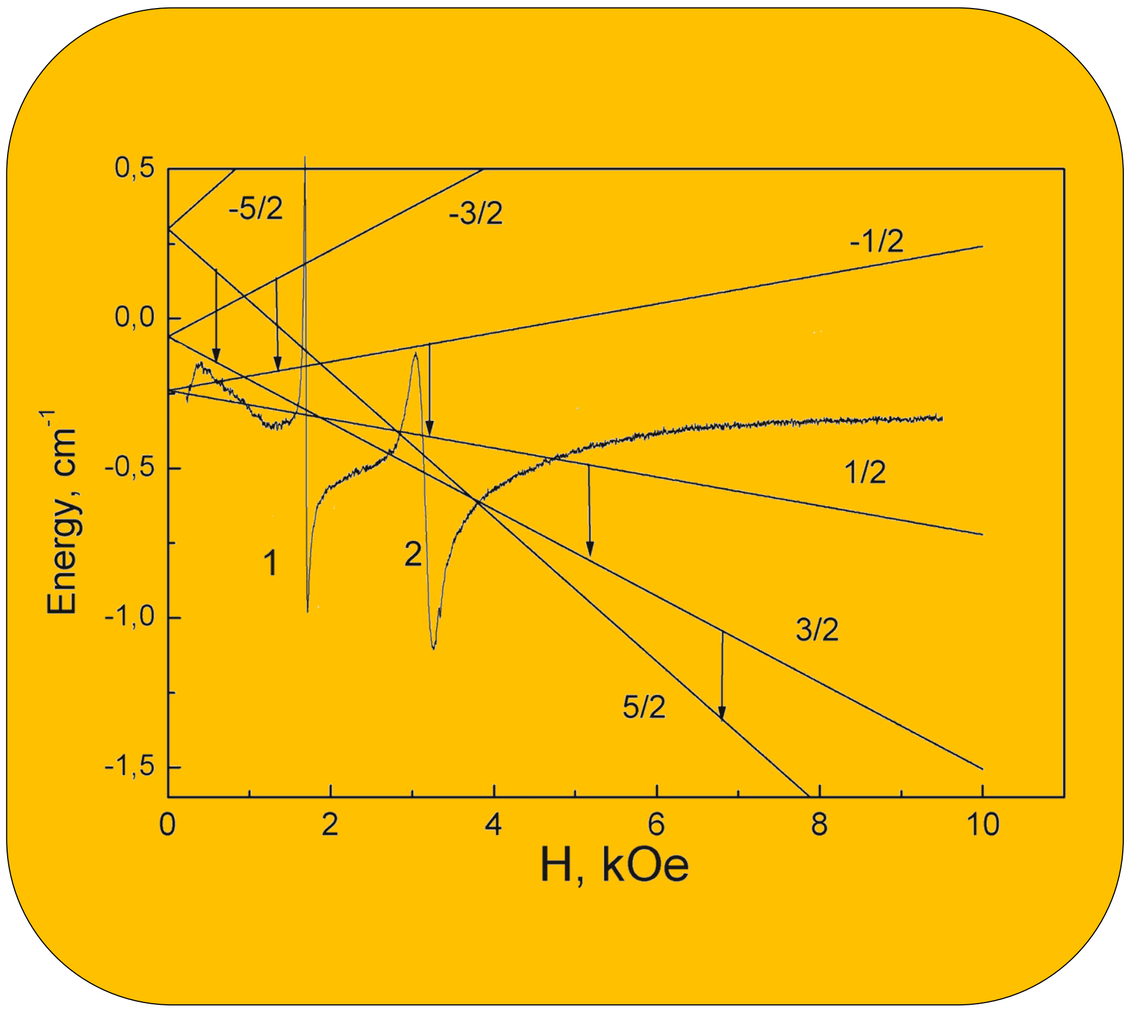
Electron Spin Resonance (ESR) spectra of nanocomplexes with Fe^{3+} ions [1] were studied on a radio spectrometer with a frequency of 10 GHz in the range from low (T=4.2K) to room (T=300K) temperatures. It is shown that at external mechanical pressures that occur when using a composite with kaolinite, the ordering of kaolinite plates occurs (Fig. 3).





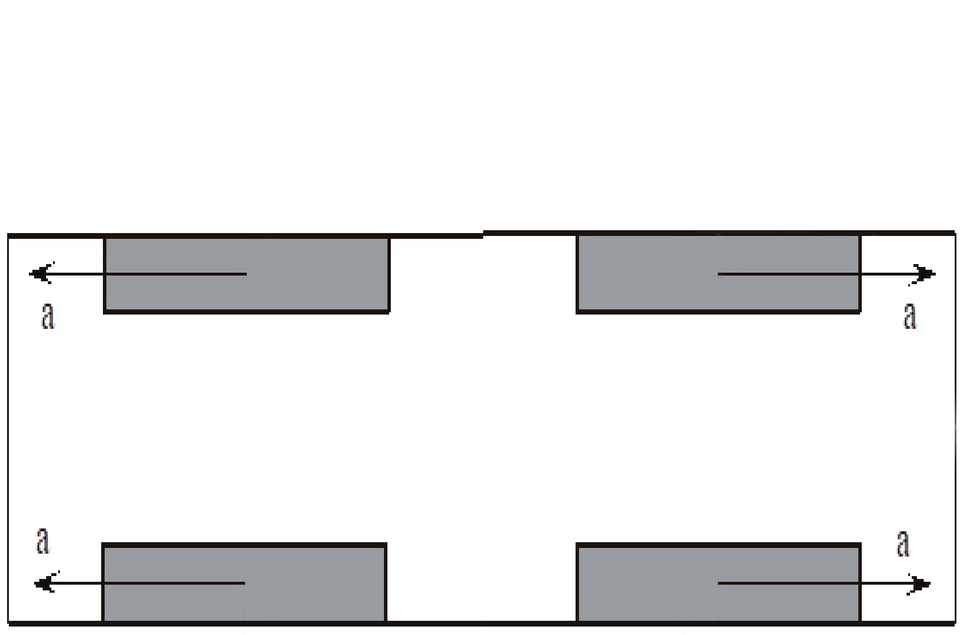


Fig.1. Unit cell of a kaolinite single crystal with Fe3+ ion. Fe3+ ions partially replace Al3+ ions. a, b are the crystallographic axes; m is the magnetic axis; the Z axis is perpendicular to the plane (ab).

Fig.2. Splitting of the energy levels of the Fe3+ ion in a single crystal with a parallel orientation of the magnetic field, the lines (arrows) of the resonant transitions ±5/2, ±3/2, ±1/2 are shown. Lines 1 and 2 are the ESR spectrum of the Fe3+ ion in a nanocomposite (powder) at T = 64K.

Fig. 3. The arrangement of kaolinite crystals along the axis of a cylindrical sample obtained at axial pressure through a die. The crystallographic axes (a Fig. 1 and 3) are located along the axis of the cylinders.

The orientation of the kaolinite plates is determined by the direction of the deformation gradient. During the deformation that occurs when using the material, the isotropic composite turns into an anisotropic one. The properties of the material change.

1. Shapovalov V. A., Shapovalov V. V., Rafailovich M., Piechota S., Dmitruk A., Aksimentyeva E., Mazur A. Dynamic Characteristic of Molecular Structure of Poly(ortho-methoxyaniline) with Magnetic Probes // The Journal Physical Chemistry C. - 2013. 117. - P. 7830−7834.