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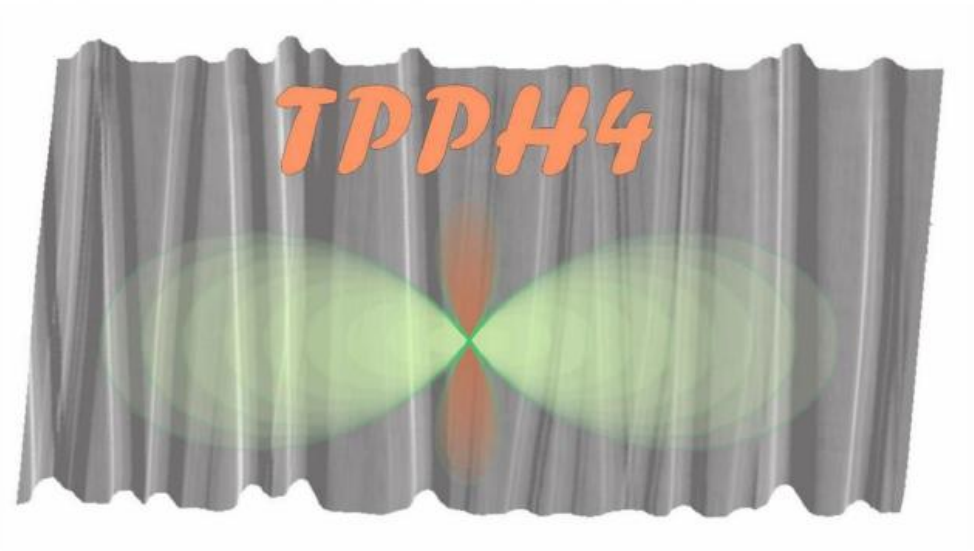

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В сборнике представлены новые экспериментальные данные и методики по дифракционным исследованиям порошков, монокристаллов и наноматериалов. Особое внимание уделено исследованиям изменений кристаллической структуры при воздействии температур, давлений и структурных замещений.

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The book of abstracts presents new experimental data and methods for diffraction studies of powders, single crystals and nanomaterials. Particular attention is paid to studies of changes in the crystal structure under the conditions of temperature, pressure and structural substitutions.

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Mössbauer effect study of iron borate $Fe^{2+}_2Fe^{3+}(BO_3)O_2$ with hulsite structure

Zinnatullin A.L. [1*], Biryukov Y.P.[2], Vagizov F.G.[1]

[1] Institute of Physics, Kazan Federal University, 18 Kremlyovskaya str, Kazan, 420008, Russian Federation

[2] Institute of Silicate Chemistry of the Russian Academy of Sciences, 2, Makarova emb., Saint Petersburg, 199034, Russian Federation

*Correspondence email: almaz.zinnatullin@gmail.com

Mixed valence oxoborates have attracted much attention of scientists recently. This is due to the fact that rather unusual magnetic properties are realized in them. The reason for this is the structural features of these compounds, which determine magnetic ordering of reduced dimension. For example, for a structure like ludwigite, quasi-one-dimensional ordering is observed, and for a structural type of pinakiolite, to which the hulsite refers, quasi-planar magnetic ordering is characteristic. Meanwhile, researchers note that oxoborates with a pinakiolite structure have been studied much less than others. In mineral deposits hulsite is found, as a rule, in the form of an iron-based mineral with tin impurity [1].

Mössbauer spectroscopy allows obtaining important information about the local environment, the valence state of resonant nuclei in a solid, and also about the magnetic ordering in it. This makes it possible to study the microscopic properties of solids in the vicinity of resonant atoms even when they are distributed in several crystallographic positions [2].

In this work we report the results of ^{57}Fe and ^{119}Sn Mössbauer effect studies of natural hulsite with idealized formula $Fe^{2+}_2Fe^{3+}(BO_3)O_2$. The mineral was collected from the Titovskoe boron deposit, Tas-Khayakhtakh Range, Polar part of Sakha (Yakutia) Republic, Russia. Mössbauer experiments were performed in transmission geometry using a conventional spectrometer (WissEl, Germany) operating in constant acceleration mode equipped with a Mössbauer Furnace MBF-1100 and temperature controller TR55. Measurements were provided within the temperature range of 295–745 K in air atmosphere. The ^{57}Co (Rh) with an activity of about 50 mCi and the ^{119m}Sn ($CaSnO_3$) with an activity of about 15 mCi (both RITVERC GmbH, Russia) were used as a source of resonance radiation. The spectrometer velocity scale was calibrated using thin metallic iron foil (at room temperature). SpectrRelax software [3] was used for experimental data processing. Isomer shifts were measured relative to α-Fe at room temperature for ^{57}Fe Mössbauer spectra and SnO_2 at room temperature for ^{119}Sn Mössbauer spectra.

The room temperature ^{57}Fe Mössbauer spectrum of hulsite was processed by sum of three components, namely, one magnetically splitted component and two paramagnetic doublets. This fact means a partial magnetic ordering of iron atoms in the hulsite. It should be caused by two-dimensional character of magnetic interaction. Hyperfine parameters of magnetically splitted component are characteristic for ferric ions, while the parameters of other components – for ferrous ions. With an increasing of temperature, hyperfine field of magnetically splitted component decreases, and magnetic splitting disappears at about 383 K. At the temperatures above 600 K, new magnetically splitted component appears. This component is related with hematite (α-Fe_2O_3), and its appearance is connected with the start of oxidation of the hulsite.

The room temperature ^{119}Sn Mössbauer spectrum is doublet with hyperfine parameters characteristic for Sn^{4+} ions. The absence of magnetic splitting shows that exchange interaction of ferric ions is not transferred through tin ions in hulsite structure.

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