MODERN DEVELOPMENT OF MAGNETIC RESONANCE

abstracts

2017

KAZAN * RUSSIA

MODERN DEVELOPMENT OF MAGNETIC RESONANCE

ABSTRACTS OF THE
INTERNATIONAL CONFERENCE

Editor:
KEV M. SALIKHOV

KAZAN, SEPTEMBER 25–29, 2017

Diluted Iron Oxide in K_2O-Al_2O_3-B_2O_3 Studied Method EPR

I. V. Yatsyk[1,2], **R. M. Eremina**[1,2], **P. S. Shirshnev**[3], and **F. G. Vagizov**[2]

[1] Zavoisky Physical-Technical Institute, Russian Academy of Sciences, Kazan 420029, Russian Federation, i.yatzyk@gmail.com
[2] Kazan Federal University, Kazan 420008, Russian Federation
[3] Saint Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO University), St. Petersburg 197101, Russian Federation

Great interest in borate glasses and crystals is due to attractive physical properties. In particular, the borate compounds, un-doped and doped with rare-earth and transition elements, are very promising materials for nonlinear optics, quantum electronics and laser technology [1, 2], scintillators and thermosluminescent dosimeters [3], detectors and transformers of the ionizing radiation [4]. We investigated the K_2O-Al_2O -B_2O_3 (KAB) glasses. The first sample was doped

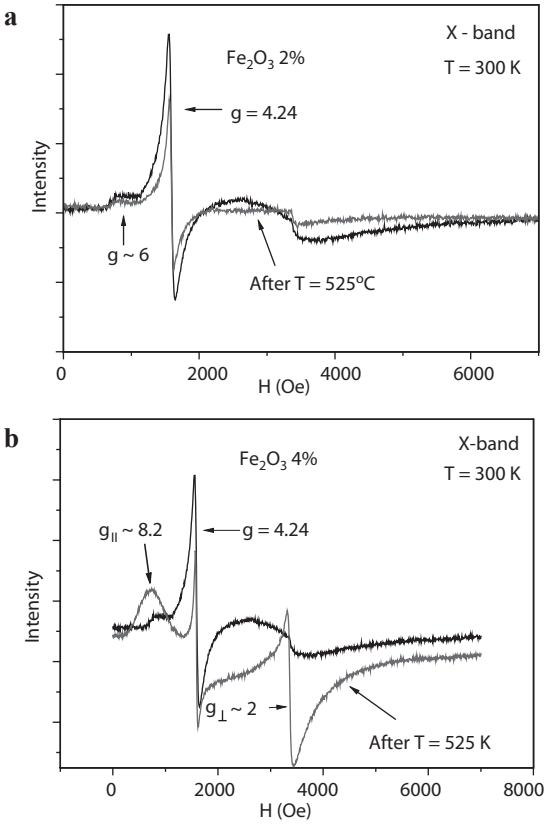

Fig. 1. The ESR spectra in KAB glasses with Fe_2O_3: **a** 2% and **b** 4%, before and after annealing.

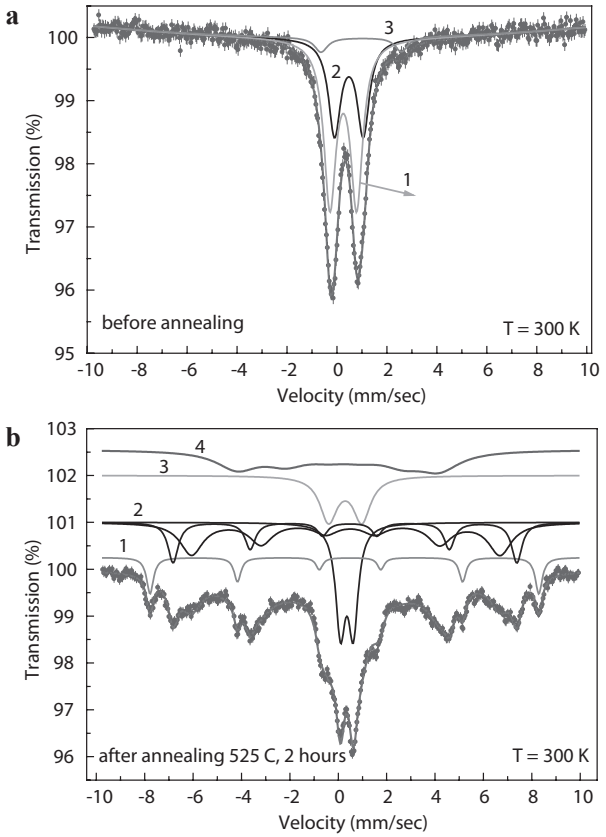

Fig. 2. Mössbauer spectra in KAB: **a** before and **b** after annealing.

by 2% and second sample has 4% Fe_2O_3 iron oxide, the third sample KAB + 4%Fe_2O_3 was annealed 2 hours at 525 °C.

The continuous wave (CW) EPR spectra of iron oxides 2% and 4% before and after annealing were recorded on a Bruker EMX+ spectrometer at the frequency of 9.4 GHz. Three group of signals were observed in magnetic resonance spectra (see Fig. 1). The first line has $g \sim 4.2$. Detailed description of the features of the spin Hamiltonian for the observation of this line are given in the paper [5]. The magnetic resonance lines of complex shapes near $g_{\|} \sim 6$ and $g_{\perp} \sim 2$ and with weak intensity were observed in spectra samples before annealing. The line with $g_{\|} \sim 6$ was described by transition between level of doublet $|\pm 1/2\rangle$ for Fe^{3+} in octahedron position where term of ground state is $^6S_{5/2}$. The intensity of magnetic resonance signals with $g_{\perp} \sim 2$ and $g_{\|} \sim 8.2$ were increased in samples after annealing process. These lines can be connected with ferromagnetic clusters α-Fe_2O_3 of large size with strong magnetic anisotropy.

A Mössbauer spectra obtained with the Mössbauer spectrometer MS-1104EM at 300 K (see Fig. 2). The Mössbauer spectrum the sample KAB + 4%Fe_2O_3 before annealing at room temperature, is a set of 3 main doublets.

Probably the doublet the No. 1 relates to the atoms of Fe^{3+} in tetrahedral positions. The doublet No. 2 can be attributed to atoms Fe^{3+} in octahedron positions. Probably Fe^{2+} ions were occupied tetrahedral positions for a doublet number 3. After annealing, the Mössbauer spectrum has changed dramatically. The sextets were formed in third sample after annealing. We believe that ferromagnetic clusters (α-Fe_2O_3) with different size were formed in third sample.

1. Kindrata I.I., Padlyaka B.V., Drzewieckia A.: Journal of Luminescence **187**, 546 (2017)
2. Babkina A.N., Khodasevicha M.A., Shirshnev P.S.: Optics and Spectros. **122**, 214 (2017)
3. Radiat U.A.: Phys. Chem. **85**, 23 (2013)
4. Adawy A.E., Khaled N.E., El-Sersy A.R., Hussein A., Donya H.: Appl. Radiat. Isot. **68**, 1132 (2010)
5. Kliava J.: Phys. Stat. Sol. (b) **134**, 411 (1986)