PHASE COMPOSITION, STRUCTURAL PARAMETERS AND MAGNETIC PROPERTIES OF BARIUM HEXAFERRITE, SYNTHESIZED BY SOL-GEL COMBUSTION USING DIFFERENT ORGANIC FUEL

R. V. MININ[*], *V. I. ITIN*[*], *V. A. ZHURAVLEV*[**], *YU. M. LOPUSHNYAK*[**], *V. A. SVETLICHNYI*[**], *I. N. LAPIN*[**], *D. A. VELIKANOV*[***], *I. YU. LILENKO*[**]

** Tomsk Scientific Center, SB RAS, Akademichesky ave 10, bld. 3, Tomsk, 634021, Russia,*
Email: waserman@ya.ru, phone: +79234061935
*** Tomsk State University, Lenin ave 36, Tomsk, 634050, Russia*
****Kirensky Institute of Physics, Federal Research Center KSC SB RAS, st. Akademgorodok 50, bld. 38, Krasnoyarsk, 660036, Russia*

Hexagonal ferrites, in particular Barium hexaferrite $BaFe_{12}O_{19}$ with the crystallographic structure of M-type, are broadly used to manufacture permanent magnets as well as various components for radar absorption material and microwave devices. A vivid scientific and practical interest to this material is caused by the fact that it possesses high values of the Curie temperature (T_C), coercive force (H_C), specific saturation magnetization (σ_S) and magnetocrystalline anisotropy field (H_{a1}). In addition, its magnetic properties are stable in a wide range of temperatures.

The synthesis of $BaFe_{12}O_{19}$ hexaferrite powders was carried in a sol-gel combustion mode. The aqueous solutions of Barium nitrate and Iron nitrate were used as reagents. The aqueous solutions of carbamide (sample 1), sucrose (sample 2), glycin (sample 3) and citric acid (sample 4) were used as an organic fuels.

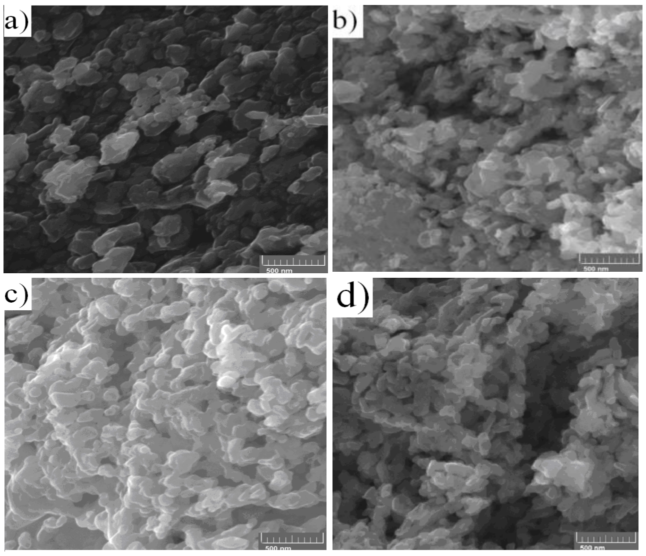

Fig 1. SEM pictures of products after sol-gel combustion and heat treatment. a) – sample No 1, b) – sample No 2, c) – sample No 3, d) – sample No 4.

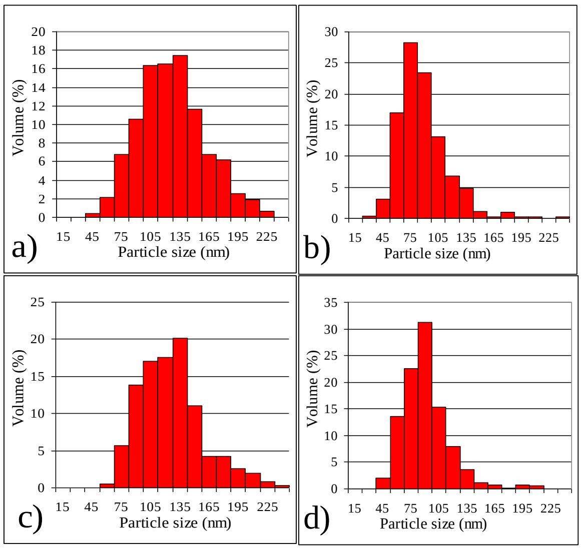

Fig 2. Bar charts with particle size distribution of products after sol-gel combustion and heat treatment. a) – sample No 1, b) – sample No 2, c) – sample No 3, d) – sample No 4.

The sample synthesized with carbamide as an organic fuel has the least target phase $BaFe_{12}O_{19}$ output ~ 77 %. Other samples contain more than 92% of Ba-M phase.

The granulometric analysis revealed that the samples obtained with the use of carbamide (No 1) and glycin (No 3) demonstrates a wide particle size distribution and the average particles size are 120 ÷ 135 nm. Whereas the samples synthesized with the use of sucrose (No 2) and citric acid (No 4) demonstrate narrower particle size distribution as well as the smaller particle size: the sample No 2 –75 ÷ 90 nm, the sample No 4 – 90 ÷ 105 nm.

The samples No 2 and No 4 with the narrow particle size distribution have the biggest value of magnetization. At room temperature it is 56.6 and 59.0 emu/g respectively. The values obtained are similar to ones given in. The paraprocess affects the magnetization processes significantly. Average paraprocess susceptibility for all samples is $\chi_{para.} \approx 0.125 \cdot 10^{-3}$ cm^3/g.

The values of the magnetomechanical ratios estimated from the FMR experiments in the limits of the experimental error are the same as for the spin moment of a free electron.