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Investigation of the crystal structure and optical properties of Bi-activated strontium aluminates

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To date, one of the most relevant areas of condensed matter physics and materials science is the production and study of Bi-activated materials that demonstrate luminescence in a wide range of visible and near-infrared ranges. One of the actively studied inorganic luminescent materials is a group of strontium aluminates as a matrix. The use of strontium aluminates is due to their ability to form a large number of phases of different composition in the SrO –Al2O3 system, which implies a purposeful influence of the matrix composition on the optical parameters of the Bi-activated luminescent materials obtained. Bismuth, in turn, is sensitive to changes in the crystal environment, which means to the composition of the matrix, crystal structure, positions occupied, defects, etc. In this regard, it is important to have a detailed understanding of the influence of the structure and composition features on the optical properties of the resulting compounds.

This work presents detailed studies of the crystal structure and optical properties of strontium aluminate samples obtained by solid-phase synthesis. Using X-ray diffraction and Raman spectroscopy, the phase composition and features of the crystal structures of the synthesized compounds were studied: for a series of samples with different ratios of the initial components SrNO3/Al2O3 and activator types - Bi2O4 or Bi2O3. The main parameters of crystal structures, the average values of bond lengths were also obtained and assumptions were made about the positions possibly occupied by bismuth in the synthesized matrix.

In addition, the luminescent properties of strontium aluminates activated by bismuth oxides were studied. From the obtained spectra of the studied samples, two-dimensional maps of the dependence of the glow on different pumping frequencies were formed. A 3D scanning of the sample was carried out using a confocal microscope, which allows selectively registering luminescence from a region limited by the size of the diffraction spot.

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