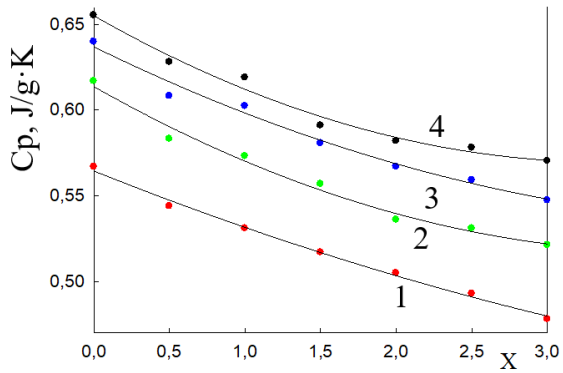
INVESTIGATION OF THE HEAT CAPACITY OF $Y_{3-x}Eu_xSc_2Ga_3O_{12}$ (0 < x < 3) SOLID SOLUTIONS

Denisova L.T., Irtyugo L.A.
Siberian Federal University
660041, Krasnoyarsk, Svobodnyi pr. 79

Yttrium-scandium-gallium garnet is a promising material for high-efficiency phosphors. Similar ionic radii, identical charge, and close electronegativity of Eu^{3+} and Y^{3+} ions facilitate lattice doping, enabling Y^{3+} substitution and solid solution formation. Substituting Y^{3+} with Eu^{3+} has the potential to enhance the luminescent properties of this material. However, the thermodynamic and thermophysical properties of the $Y_{3-x}Eu_xSc_2Ga_3O_{12}$ system have not been systematically studied.

Solid solutions of the $Y_{3-x}Eu_xSc_2Ga_3O_{12}$ system ($0<x<3$) were synthesized by a high-temperature solid-state reaction at 1793 K using B_2O_3 as a flux. The phase purity of the obtained samples was verified by XRD using a Bruker D8 diffractometer with a VANTEC -1 linear detector and CuKα radiation. The synthesized garnets belong to the cubic space group $Ia\bar{3}d$.

The temperature dependence of the heat capacity for all obtained substances was determined by differential scanning calorimetry (DSC) using a STA 449 S Jupiter instrument. The experiments were conducted in platinum crucibles with lids, with a heating rate of 20 K/min, from 323 K to 1023 K in an air atmosphere. The obtained results are presented in the figure.



Dependence of the specific heat capacity on the composition of $Y_{3-x}Eu_xSc_2Ga_3O_{12}$: 1 – T = 323 K, 2 – T = 523 K, 3 – T = 723 K, 4 – T = 923 K

Substitution of Y^{3+} ions with Eu^{3+} ions leads to a nonlinear decrease in heat capacity in the $Y_{3-x}Eu_xSc_2Ga_3O_{12}$ system throughout the studied temperature range.

The work was carried out within the framework of the state assignment of the Ministry of Science and Higher Education of the Russian Federation for science of the Siberian Federal University, project FSRZ-2026-0011.