HEXAALUMINATES WITH MAGNETOPLUMBITE STRUCTURE FOR ADVANCED THERMAL BARRIER COATINGS: THERMODYNAMIC AND THERMOPHYSICAL PROPERTIES

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To protect parts of power plant and aircraft engine turbines that are explored at high temperatures and high-temperature corrosion, thermal barrier coatings (TBC) are used, which have a number of requirements for thermal conductivity, thermal expansion, corrosion resistance at high temperatures and long-term stability [1]. An increase in turbine efficiency can be achieved by using advanced ceramic coatings with higher performance. In particular, hexaaluminates with a magnetoplumbite structure are among the most promising candidates for TBC [2].

Based on experimental measurements of heat capacity, enthalpy of formation, thermal expansion, and thermal conductivity were made the conclusions about the prospects of using magnetoplumbite structure hexaaluminates $LaAl_{11}O_{18}$, $REMgAl_{11}O_{19}$ (RE=La-Gd), $LaM(II)Al_{11}O_{19}$ (M(II)=Mn,Zn,Co,Cu), as well as solid solutions $(NdSmGd)_{1/3}MgAl_{11}O_{19}$, $(LaPrNdSm\ Gd)_{1/5}MgAl_{11}O_{19}$, $La(MgMnCu)_{1/3}Al_{11}O_{19}$, $La(MgMnZnCoCu)_{1/5}Al_{11}O_{19}$ as components of TBC materials.

The stability of the studied hexaaluminates in the high temperature range was analyzed based on the temperature dependence of the Gibbs energy of possible decomposition reactions into simpler oxides. The assessment of corrosion resistance to the effects of oxides of the CMAS group was carried out by DSC and XRD, as well as by model calculation. Thermal expansion was determined by dilatometry and X-ray diffraction. Thermal conductivity in the high temperature range was calculated from thermal diffusivity data determined by the laser flash.

As a result of the performed studies, the most promising mixed oxides were identified. For hexaaluminates with the magnetoplumbite structure the influence of the number of components of solid solutions on the enthalpy and entropy components of the Gibbs energy of formation is assessed.

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2. R.I. Webster, N. Bansal, G. Costa. Thermodynamic properties of $LaMAl_{11}O_{19}$ (M = Mg, Mn, Zn) magnetoplumbites. // Mater. Chem. Phys. 2026. V.349. P.131786.

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