DENSITY INVESTIGATION OF AlNiCoFeCr ALLOYS IN SOLID AND LIQUID STATES

Simonov D.K., *Rusanov B.A.*, *Sidorov V.E.*
Ural State Pedagogical University
620091, Ekaterinburg, Cosmonavtov ave., 26

High-entropy alloys (HEAs) containing aluminum and transition metals have been actively studied in recent years due to their high functional properties (primarily, mechanical characteristics and corrosion resistance). Information on the physical properties of such alloys is a sought-after area in thermophysics and physics of condensed matter. In this work, the volumetric characteristics (density, molar volume) of HEAs with AlNiCoFeCr compositions have been studied.

AlNiCoFeCr alloys with different component ratios were prepared from pure initial metals (Al – 99.999 %, Ni – 99.5 %, Co – 99.5 %, Fe – 99.8 %, Cr – 99.9 %) in an induction furnace at a temperature of 1800 K under a protective helium atmosphere. The melting was carried out for half an hour in Al_2O_3 crucibles.

Density of the samples was studied using the absolute version of gamma-absorption method. The samples were investigated in Al_2O_3 crucibles under a protective helium atmosphere. The experiments were conducted in the heating and subsequent cooling mode at a rate of 5 K/min in solid state and 2 K/min in liquid state. Based on the experimental density data, molar volumes of the melts at high temperatures were calculated.

From the experimental results, it was established that density of the alloys in solid state decreases over the entire investigated temperature range. Melting of the alloys is associated with a stepwise decrease in density, and in the liquid state, temperature dependecies of density can be described by a linear functions.

The results obtained from the conducted experiments can be used for further research on high-entropy AlNiCoFeCr alloys, as well as for optimizing the production process of new functional high-entropy materials.