HEAT CAPACITY AND VISCOSITY OF GLASSES AND MELTS IN THE SYSTEM Al_2O_3-CaO-MgO-SiO_2-TiO_2

Zhomin G.M., Arkhipin A.S., Kondratiev A.V.
Lomonosov Moscow State University
119991, Moscow, Leninskie Gory, 1

Experimental measurements of heat capacity and modelling of heat capacity and viscosity of melts and glasses in the Al_2O_3-CaO-MgO-SiO_2-TiO_2 system have been presented for selected unary, binary, ternary and quaternary subsystems. Adiabatic and differential scanning calorimetry have been used to measure heat capacity of synthesized glasses at low, intermediate and high temperatures. A unified model for both heat capacity and viscosity of melts and glasses in the Al_2O_3-CaO-MgO-SiO_2-TiO_2 system has been developed on the basis of the configurational entropy theory [1], extensive experimental database for viscosity [2] and collected from literature and measured heat capacity data. First, heat capacity of glasses has been modelled at temperatures above 300 K using a simple polynomial expression. Second, viscosity of melts and glasses has been described over a wide temperature range via the configurational heat capacity and Adam-Gibbs theory. Compositional dependences of the heat capacity and viscosity parameters have been described by both linear and quadratic rules of mixing depending on availability and/or agreement with experimental data. Using the developed model both heat capacity and viscosity of melts and glasses can now be predicted over the wide temperature and compositional ranges in the Al_2O_3-CaO-MgO-SiO_2-TiO_2 system including supercooled melts and glasses.

1. Adam, G., Gibbs, J.H. On the temperature dependence of cooperative relaxation properties in glass-forming liquids // J. Chem. Phys. 1965. Vol. 43. P. 139-146. https://doi.org/10.1063/1.1696442

2. Kondratiev, A. OxiVis database of experimental viscosities in the oxide melts and glasses // 2004-2026. Available on request via al.v.kondratiev@gmail.com

This work was financially supported within the framework of the State Program "Chemical Thermodynamics and Theoretical Materials Science" at the Lomonosov Moscow State University (№121031300039-1).