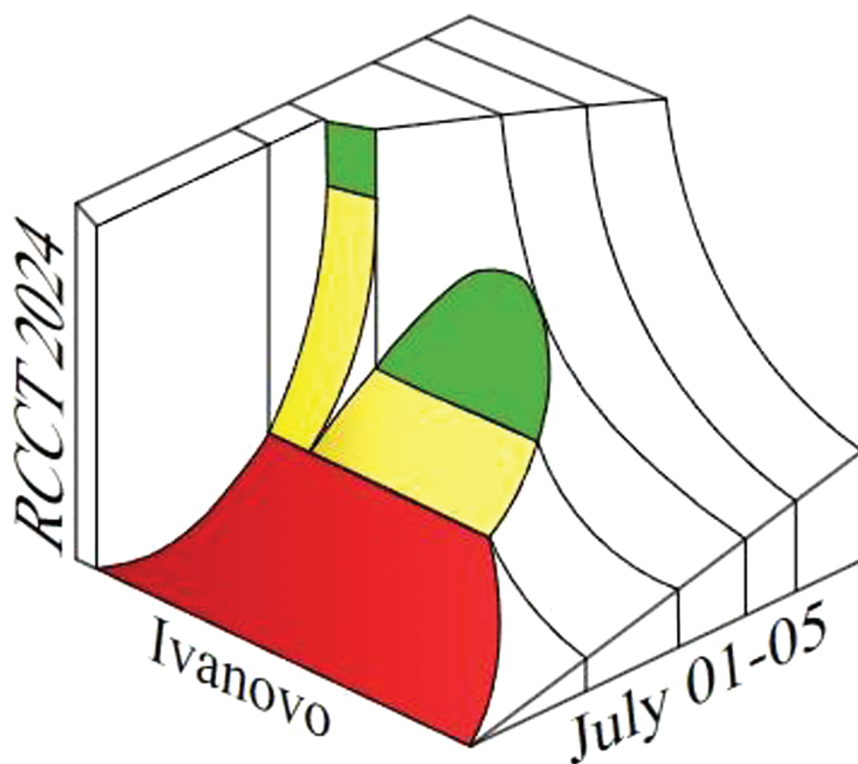


XXIV International Conference on Chemical Thermodynamics in Russia

**July 1-5, 2024
Ivanovo, Russia**

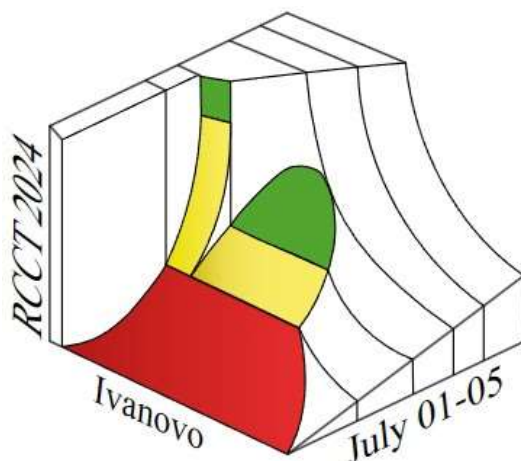


RCCT-2024

BOOK OF ABSTRACTS

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G.A. Krestov Institute of Solution Chemistry of the Russian Academy of Sciences

Ivanovo State University of Chemistry and Technology

**Kurnakov Institute of General and Inorganic Chemistry of the Russian Academy of
Sciences**

Ministry of Science and Higher Education

Russian Academy of Sciences

Mendeleev Russian Chemical Society

Scientific Council for Physical Chemistry of the Russian Academy of Sciences

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**VAPORIZATION AND THERMODYNAMIC PROPERTIES
IN THE Cs₂O-Al₂O₃-SiO₂ AND SrO-Al₂O₃-SiO₂ SYSTEMS
STUDIED AT HIGH TEMPERATURES**

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The vaporization processes and thermodynamic properties in the Cs₂O-Al₂O₃-SiO₂ and SrO-Al₂O₃-SiO₂ systems were studied by the high temperature mass spectrometric method. The samples in the system under consideration were synthesized by the sol-gel method. The samples obtained were characterized by X-ray phase analysis. This study was performed using the MS-1301 mass spectrometer at an ionizing voltage of 25 V. Samples of Cs₂O-Al₂O₃-SiO₂ system were evaporated from a single Knudsen effusion cell heated by resistance furnace. The temperature was measured with a platinum-platinum-rhodium thermocouple. The samples of the SrO-Al₂O₃-SiO₂ system were evaporated from twin effusion cell heated by electron bombardment. In one of the compartments of the cell, the studied sample was loaded, and in the second, comparative, individual SrO or SiO₂. In that case the temperature was measured by an optical pyrometer. Instrument calibration was performed using the calcium fluoride.

The vaporization of the samples in the Cs₂O-Al₂O₃-SiO₂ system was observed at temperatures above 750-900 K, depending on the Cs₂O content. The main vapor species over the samples were Cs and O₂, leading to selective removal of Cs₂O from the samples. The vaporization of the samples without Cs₂O was observed at temperatures above 1800 K, with the main vapor species being SiO, Al, AlO, Al₂O and O. The temperature dependences of the partial pressures of the atomic cesium over the samples under study allowed us to determine the activity of cesium oxide and the chemical potential of Cs₂O and excess Gibbs energies. Negative deviations from the ideal behavior were illustrated in the system under study at the temperature range 750-900 K.

A characteristic feature of the SrO-Al₂O₃-SiO₂ system is the rather different volatility of the constituent components. The most volatile one is silicon dioxide, the least volatile component is aluminum oxide. During isothermal aging, the composition of the condensed phase of the system under study is constantly depleted of silicon and strontium oxides, and enriched with aluminum oxide.

The obtained values of the activities of strontium oxide in the studied samples indicate the presence of a negative deviation from ideality in the temperature range 1950-2100 K. In the same temperature range, the values of SiO₂ activity are close to the ideal state. It was found that in samples containing 30 SrO:50 Al₂O₃:20 SiO₂ and 30 SrO:20 Al₂O₃:50 SiO₂ (mol. %), with a relative increase in the concentration of SiO₂ and a decrease in the concentration of Al₂O₃ in the sample, the value of the SrO activity decreases. This is due to the fact that the difference in acid-base properties of oxides in the SrO-SiO₂ system is greater than in the SrO-Al₂O₃ system. However, the lowest the SrO activity is typical for a sample containing 33 SrO:33 Al₂O₃:33 SiO₂ (mol. %).

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