THERMODYNAMIC PROPERTIES OF THE CeO_2-B_2O_3 SYSTEM

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The various CeO_2 based systems is of practical interest because their high ion conductivity and potential using for SOFC. On other hand B2O3 containing system uses as glasses for special purposes. Prediction of the behavior at high temperatures of such systems require the information of quantitative composition of vapor as well as thermodynamic properties (such as activities, activity coefficients and partial thermodynamic functions) for all components. In this study CeO_2-B_2O_3 system was studied by Knudsen effusion mass spectrometry (KEMS) as well as thermodynamics of the gaseous cerium oxyacid salt $CeBO_2$. Investigation was done using MS 1301 mass spectrometer at the ionization energy equaled to 30 eV. Vaporization of the samples under consideration was carried out from molybdenum and tungsten effusion cells heated by the electron bombardment. Temperature was measured by optical pyrometer EOP-66 with the accuracy ±10. Samples were obtained by heating mixtures of CeO_2 and orthoboric acid.

The $B_2O_3^+$, CeO^+ and CeO_2^+ ions were detected in mass spectra above the system under study in the temperature range 1500-2100 K. The mass spectrum analyses and appearance energies of ions in mass spectrum shown that the vapor over the systems consist of B_2O_3, CeO, CeO_2 and O molecules. The partial pressures of these vapor species were obtained using the ion current comparison method with silver as inner standard. Additionally gaseous molecule $CeBO_2$ was detected in the vapor. For this species standard formation enthalpy was derived.

In the studied system ceria is stabilized by second component and decomposition to Ce_2O_3 in the condensed phase wasn't observe. The thermodynamic activities of CeO_2 and B_2O_3 at the temperature 1600 K were found by the differential mass spectrometric method using ceria and B_2O_3 as the standard of the determination of the component activities. The CeO_2-B_2O_3 system demonstrate strong negative deviation from ideal case for boron oxide and weak negative deviation for ceria.