HIGH-TEMPERATURE(UP TO 4000 K) INVESTIGATION OF VAPOR COMPOSITION OF NONSTOICHIOMETRIC ZRC_X AND TAC_X IN THE VICINITY OF THE HOMOGENEITY DOMAIN

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Tantalum and zirconium carbides are promising materials for a range of high-temperature applications. However, the present data on evaporation of the materials is related to 60-70th [1,2]. It was obtained using stationary heating techniques and thus limited at the temperature of 3000 K.

Nowadays there is a capability to analyze the vapor composition above melting point over the surface with a changing composition [3] using laser heating with millisecond pulses combined with time-of-flight mass-spectrometry. Using the method we investigated the vapor composition of zirconium and tantalum carbides with initial composition lying within the homogeneity domain. To measure the emissivity of substances in solid and liquid states the method of polychromatic pyrometry was used. The data on relative vapor pressures of different molecular species in vapor over the surface of liquid tantalum and zirconium carbides was obtained for the first time. It was shown that zirconium carbide vapor at temperatures above 3500 K consists mainly of zirconium and carbon atoms with small quantity of ZrC_2 and Zr_2C. Vapor over specimen with initial ratio of C/Zr>0.8 also contains C_2 and C_3 molecules which may appear due to evaporation of small inclusions of free carbon in carbide. It turned out that at the temperature above 4000 K the ration C/Zr in vapor over the surface tends to the value of about 0.2 irrespective of the initial composition.

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1. Jackson H. F., Lee W. E. Properties and characteristics of ZrC. in Comprehensive nuclear materials. ed. R. J. M. Konings. 2012. Oxford. Elsevier. pp. 339-372.
2. Deadmore D. L. Vaporization of Tantalum Carbide-Hafnium Carbide solid Solutions Journal of the American Ceramic Society. 1965. p. 357
3. Pflieger R., Colle J.Y, Iosilevskiy I., Sheindlin M. Urania vapor composition at very high temperatures. J. Appl. Phys. 2011. 109, p. 03351