Experimental investigation of thermal expansion of refractory metal carbide at fast pulse-heating and high temperatures

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Studies of the thermal expansion of refractory carbides (for example, NbC, Mo_2C, TiC) and, in particular, the effect of carbide stoichiometry on the thermal expansion coefficient during rapid electrical heating of 10^7–10^8 K/s, are currently of great interest. The temperature dependence of the thermal expansion of refractory carbides on their stoichiometry is an important factor for their practical use and theoretical study. The novelty of the proposed approach is the use of precision technology of optical pyrometry, high-speed digital visualization of the thermal expansion of the materials under study, as well as the possibility of using various heating rates. The chosen approach allows us to investigate the thermal expansion coefficient of refractory carbides over a wide range of high temperatures for stoichiometries previously unstudied. Direct measurement of the sample temperature makes it possible to switch off the heating at a given temperature in real time (during the experiment). This allows us to investigate the change in the microstructure of the sample (after the experiment) after it reaches a predetermined temperature, which provides a study of the phase behavior of the sample upon heating and control of the change in its stoichiometry, which is especially important for refractory carbides. This work contains an experimental study of molybdenum and niobium carbides thermal expansion at high temperatures up to the melting temperatures by the method of pulse electrical heating.

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