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Pulse Method for Investigation of Zr-C Phase Diagram at High Carbon Content Domain under High Temperatures

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Abstract : The microsecond electrical pulse heating technique which provides uniform energy input into an investigated specimen is considered. In the present study we investigated ZrC+C carbide specimens in a form of a thin layer (about 5 microns thick) that were produced using a method of magnetron sputtering on insulating substrates. Specimens contained (at. %): Zr–17.88; C–67.69; N–8.13; O–5.98. Current through the specimen, voltage drop across it and radiation at the wavelength of 856 nm were recorded in the experiments. It enabled us to calculate the input energy, specific heat (from 2300 to 4500 K) and resistivity (referred to the initial dimensions of a specimen). To obtain the true temperature a black body specimen was used. Temperature of the beginning and completion of a phase transition (solid–liquid) was measured.Temperature of the onset of melting was 3150 K at the input energy 2.65 kJ/g; temperature of the completion of melting was 3450 K at the input energy 5.2 kJ/g. The specific heat of the solid phase of investigated carbide calculated using our data on temperature and imparted energy, is close to 0.75 J/g□K for temperature range 2100–2800 K. Our results are considered together with the equilibrium Zr-C phase diagram.

Keywords : pulse heating, zirconium carbide, high temperatures, melting
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