Thermophysical Properties of the Carbide TaC Near the Melting Point and in the Liquid State

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Tantalum carbide (TaC) is an ultra-high-temperature substance for potential applications as protective coating in atomic industry, furnace components, aircraft and space implementations, etc. Resistivity and thermophysical properties of TaC (in the thin layer form) has been investigated against temperature in the present study. Apart from TaC, the Ta itself (as a metal) was investigated in this study (in the same thin layer form). TaC carbide (estimated melting temperature 4200 K) was investigated under fast-pulse electrical heating to give experimental data for high-temperature region. The thin carbide specimens (1-7 microns) were obtained by magnetron sputtering on the quartz surface. The investigated cell was constructed as a thin layer of TaC on the well-polished surface with the dimensions 8 mm × 14 mm. It needs small electrical current (1-2 kA) to ensure fast heating during 5 microseconds. The melting plateau was measured by fast pyrometer that has been calibrated beforehand. Radiation of the tungsten strip was directed through a rotating chopper and was used in calibration procedure. A final estimation of temperature for tantalum used emissivity values. Melting temperature for TaC was estimated in the fast heating process also. Liquid state of the carbide was investigated and data on the carbide resistivity at the temperatures 4200 – 5000 K will be reported.