study of Heat Resistance of Zirconium Dioxide Coatings Generated by plasma treatment in electrolytes

S.V. Savushkina1, M.N. Polyansky1, A.M. Borisov2, A.V. Vinogradov2, T.E. Dankova1, V.B. Lydin2, and L.E. Agureev1

1Keldysh research center, Moscow, Russia, nanocentre@kerc.msk.ru
2MATI–Russian State Technology University, Moscow, Russia, tompve2005@yandex.ru

Zirconia coatings are often used as the top thermal barrier layers of thermal barrier coatings (TBS) [1, 2]. Zirconia coatings is most often formed using techniques of electron beam deposition and thermal spraying. A promising method of producing zirconia coating is a method of micro-arc oxidation (MAO) [3–5]. The coatings produced by MAO have properties required for thermal barrier layers: high adhesion, thickness of 100÷300 µm and the possibility to change the structure and properties of coatings by changing of processing parameters. The papers presented the study of thermal conductivity and thermal resistance of zirconia coatings obtained by plasma treatment in electrolytes are almost absent.

In this study the heat resistance and thermal conductivity of zirconia coating of 200 mkm thickness obtained on zirconium by micro-arc oxidation (MAO) were experimentally investigated. The structure of the coatings before and after temperature cycling tests up to 2000 °C using a 107 W/m2 heat flux of plasmatron was studied by scanning electron microscopy and X-ray diffraction. After seven cycles (in 120 s) of the coating exposure in nitrogen plasma they kept their integrity with minor defects of the ceramic layer and the thermal conductivity increased from 0.2 W/(m·K) after the first cycle to 0.5 W/(m·K) after seven cycles. The increase in thermal conductivity was assumed to be result of the solid phase caking and crystallization of silica in the upper coating layer.

References

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