SUMMARY

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Title: **Influence of RE_2O_3 rare earth oxides on properties of the thermal barrier coating produced from ZrO_2 oxide**

The scientific and research issue of this cognitive dissertation consisted in an attempt to develop chemical composition of a mixture of ZrO_2 oxide and rare earth oxides from the RE_2O_3 lanthanides group (including: Er_2O_3, Gd_2O_3, Nd_2O_3, and Yb_2O_3) and the conditions for synthesis thereof to obtain zirconates of $RE_2Zr_2O_7$ rare earth metals. Verification of the developed chemical composition of the ZrO_2 + RE_2O_3 mixture was carried out in the high-temperature sintering process. There were determined physical and thermal properties of zirconate sinter. This provided basis for application of the developed chemical composition of the oxide mixture for production of ceramic layers in the PS-PVD plasma spray process under the reduced pressure. There was assumed a research hypothesis that a plasma spraying process creates conditions (temperature and time) for carrying out a full synthesis of ZrO_2 oxide and RE_2O_3 oxide (Er_2O_3, Gd_2O_3, Nd_2O_3 and Yb_2O_3) and a possibility of obtaining an external layer of thermal barrier coatings from $RE_2Zr_2O_7$ zirconate. Ceramic layers were produced in the PS-PVD process on the Inconel 713C superalloy substrate with a metallic material and graphite interlayer. A chemical and phase composition analysis confirmed that $RE_2Zr_2O_7$ zirconates were generated under specific PS-PVD process conditions. Examination of thermal properties showed that the layers of $Er_2Zr_2O_7$, $Gd_2Zr_2O_7$, $Nd_2Zr_2O_7$ and $Yb_2Zr_2O_7$ zirconate are characterized by lower diffusivity and thermal conductivity in comparison to conventional layers made of the Y_2O_3 oxide-modified ZrO_2 oxide. In a microscopic analysis, there was observed a column structure with good performance characteristics. The performed thermal fatigue tests confirmed good thermal fatigue resistance of the zirconium layer of the heat barrier coating. The obtained results constituted a sound basis for developing a process of producing zirconate layer under industrial conditions.

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