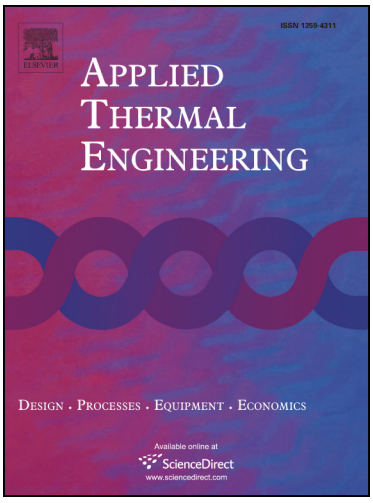

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Experimental and Numerical Study of Thermal Conductivity of Plasma-Sprayed Thermal Barrier Coatings with Random Distributions of Pores

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Abstract

Numerical and experimental investigations were conducted to find the effect of percentage and distribution of porosity and heat treatment on the conductivity value in the plasma-sprayed thermal barrier coatings (TBC). The numerical analysis of the SEM images of six plasma-sprayed samples showed an explicit relation between changes in the porosity percentage and the conductivity. Also, with a similar analysis, it was shown that the distribution of porosity and its orientation do not have a significant impact on the conductivity magnitude. A correlation was established for the variation of conductivity with respect to the material porosity. The experimental results indicated that applying a heat treatment at 1070 °C leads to an increase in the conductivity for 5 to 30 percent in the APS TBCs.

Keywords: thermal barrier coating; thermal conductivity; sintering effect; porosity; random distributions.

1 Introduction

Constant need for the enhancement of performance of gas turbines has increased demands to higher input temperature of entering gases. The increase of temperature and surpassing the limit of materials' strength, lead to the rapid emergence of phenomena such as creep, changes in mechanical properties, the oxidation and the corrosion, and shortening the life of the metal materials [1–3]. Today, working in high temperatures in applications such as

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