www.jnm.iau-shahrood.ac.ir
Nanomaterials 8:27 (2016) 206

Improving the Thermal Shock Resistance of Functionally Graded Thermal Barrier Coating by Creating Nanostructure in the Ceramic Top Coat

H.R. Moghaddam[*,1], A. Davodi[2] and M. Akbari-Baseri[3]

1- Department of Materials Engineering, Khorasan e Razavi Science and Research Branch, Islamic Azad University, Neyshabur, Iran
2- Ferdowsi University of Mashhad, Faculty of Engineering, Department of Materials Engineering, Mashhad, Iran
3- Iranian Space Research Center, Tehran, Iran

(Received: 15 September 2016, Revised: 22 October 2016, Accepted: 19 November 2016)

Abstract

This study was performed to compare the behavior of thermal shock resistance of two types of five-layer functionally graded thermal barrier coatings. The substrate material was selected from 17-4 PH stainless steel. The first type, a typical five-layer coating with CoNiCrAlY layer as a bond coat and YSZ layer as a top coat and three layer between them contains a mixture of YSZ+CoNiCrAlY powder ratio is specified. In the second type, nanostructured YSZ layer as a top coat and the other layers is quite similar to the first. To compare these coatings with conventional coating, are examples of two-layer thermal barrier coatings were tested. Samples were prepared by plasma spraying in the natural atmosphere. Thermal shock test was carried out at a temperature of 950 °C for repeated five-minute intervals and then quenched in water with temperature about 25-20 °C and was continued to destruct all the samples. A visual spalling of 20 percent of the coat was considered as criterion for thermal shock resistance. Microstructural evaluation of samples after the thermal shock test was carried out by SEM equipped with EDS. Finally, it was observed that the thermal shock life-time of conventional FG-TBC was approximately 1.5 times higher than the conventional TBC. as well as the thermal shock lifetime of nanostructured FG-TBC was approximately 14% higher than the conventional FG-TBC.

***Keywords*:** Thermal barrier coating, Functionally graded materials, Plasma spray, Thermal shock.

* **Corresponding Author:** Hamid Reza Moghaddam
Address: Neyshabur, Islamic Azad University, Khorasan e Razavi Science and Research Branch
Tel: 051-38783521, **Fax:** 051-38783521, **E-mail:** hr63mo@gmail.com