Role of internal oxidation on the failure of air plasma sprayed thermal barrier coatings with a double-layered bond coat

Zhonghua Zou, Libing Jia, Lixia Yang, Xiao Shan, Lirong Luo, Fangwei Guo, Xiaofeng Zhao, Ping Xiao

PII: S0257-8972(17)30372-9
DOI: doi: 10.1016/j.surfcoat.2017.04.026
Reference: SCT 22269

To appear in: *Surface & Coatings Technology*

Received date: 28 February 2017
Revised date: 30 March 2017
Accepted date: 10 April 2017

Please cite this article as: Zhonghua Zou, Libing Jia, Lixia Yang, Xiao Shan, Lirong Luo, Fangwei Guo, Xiaofeng Zhao, Ping Xiao , Role of internal oxidation on the failure of air plasma sprayed thermal barrier coatings with a double-layered bond coat. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2017), doi: 10.1016/j.surfcoat.2017.04.026

Role of Internal Oxidation on the Failure of Air Plasma Sprayed Thermal Barrier Coatings with a Double-layered Bond Coat

Zhonghua Zou[a], Libing Jia[b], Lixia Yang[a], Xiao Shan[a], Lirong Luo[a], Fangwei Guo[a], Xiaofeng Zhao[a, *], Ping Xiao [c]

[a] Shanghai Key Laboratory of Advanced High-temperature Materials and Precision Forming, Shanghai Jiao Tong University, Shanghai 200240, China

[b] Gas Turbine Development Center, Corporate Technology, Siemens Ltd., China

[c] School of Materials, University of Manchester, Grosvenor Street, Manchester M1 7HS, UK

Abstract

Failure of air plasma sprayed (APS) thermal barrier coatings (TBCs) with a double-layered bond coat was investigated. The bond coat consists of a dense layer near the substrate side and a porous layer on the surface. Both were made of NiCoCrAlY alloy and deposited using high velocity oxygen-fuel technique. After thermal cycling, a large amount of internal oxides formed (up to 45% in volume fraction), introducing a significant volume expansion both in in-plane and perpendicular direction in the bond coat. However, the presence of the ceramic top coat can suppress the bond coat in-plane swelling thus lowering the internal oxidation rate. Compared with the fully dense bond coat, the interface roughness of the porous bond coat increases significantly when internal oxidation occurs. There is a strong correlation between the internal oxidation and the interface roughness. In addition, both the beneficial and detrimental effects of internal oxidation on TBC failure were discussed. It is proposed that a fully dense bond coat with a proper surface roughness should have a longer thermal cycling

* Corresponding author Tel./fax: +8621 54742561.
E-mail address: xiaofengzhao@sjtu.edu.cn (X. Zhao).