Accepted Manuscript

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PII: S0257-8972(16)31309-3
DOI: doi: 10.1016/j.surfcoat.2016.12.021
Reference: SCT 21878

To appear in: *Surface & Coatings Technology*

Received date: 29 March 2016
Revised date: 1 December 2016
Accepted date: 5 December 2016

Please cite this article as: Abdullah Cahit Karaoglanli, Ahmet Turk, Ismail Ozdemir , Isothermal oxidation behavior and kinetics of thermal barrier coatings produced by cold gas dynamic spray technique. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2016), doi: 10.1016/j.surfcoat.2016.12.021

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Isothermal Oxidation Behavior and Kinetics of Thermal Barrier Coatings Produced by Cold Gas Dynamic Spray Technique

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Abstract:

The cold gas dynamic spray (CGDS) method was employed to deposit the CoNiCrAlY bond coats of thermal barrier coating (TBC) system. The oxidation behavior of the coatings were investigated under isothermal oxidation at 1000 °C, 1100 °C and 1200 °C for 8, 24, 50 and 100 h. Recent studies on TBCs have concentrated on the CGDS process and its properties under working conditions. The motivation of this study is to investigate the oxidation behavior of TBCs produced using CGDS technique under service conditions and to determine the oxidation growth kinetics of thermally grown oxide (TGO). The results show that the isothermal degradation of coatings was considerably influenced by microstructure of coating, interfacial oxide growth rate, oxidation temperature and time.

Keywords: Cold gas dynamic spraying (CGDS); Thermal barrier coatings (TBCs); Oxidation; Thermally grown oxide (TGO); Oxidation rate

1. Introduction

Gas turbine engines are used to convert burning products to kinetic energy to obtain propulsion in the aerospace industry as a power generation facility [1]. Thermal Barrier Coatings (TBCs) are usually preferred to reduce the heat transfer and decrease the thermal loads of gas turbine components such as turbine blades, vanes and combustors [2-4]. The structure of state-of-the art TBCs which are used for gas turbines includes 4 layers. The first layer is nickel-based super alloy substrate to take advantage of high creep strength, superior mechanical and chemical properties. The second layer or bond coat is MCrAlY alloy which

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