Investigation of the resistance of open-column-structured PS-PVD TBCs to erosive and high-temperature corrosive attack

Stefan Rezanka, Daniel Emil Mack, Georg Mauer, Doris Sebold, Olivier Guillon, Robert Vaßen

PII: S0257-8972(17)30459-0
DOI: doi: 10.1016/j.surfcoat.2017.05.003
Reference: SCT 22322

To appear in: *Surface & Coatings Technology*

Received date: 6 January 2017
Revised date: 17 April 2017
Accepted date: 2 May 2017

Please cite this article as: Stefan Rezanka, Daniel Emil Mack, Georg Mauer, Doris Sebold, Olivier Guillon, Robert Vaßen , Investigation of the resistance of open-column-structured PS-PVD TBCs to erosive and high-temperature corrosive attack, *Surface & Coatings Technology* (2017), doi: 10.1016/j.surfcoat.2017.05.003

Investigation of the resistance of open-column-structured PS-PVD TBCs to erosive and high-temperature corrosive attack

Stefan Rezanka[1,2], Daniel Emil Mack[1,2]*, Georg Mauer[1,2],Doris Sebold[1,2], Olivier Guillon[1, 2], Robert Vaßen[1,2]

[1]Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research, Materials Synthesis and Processing (IEK-1), 52425 Jülich, Germany

[2]Jülich Aachen Research Alliance: JARA-Energy

Abstract

In modern gas turbines, highly loaded components are internally cooled and furthermore covered with thermal barrier coatings (TBCs) to withstand the harsh operating conditions with temperatures exceeding the application limit of such coatings. Under realistic operating conditions, siliceous minerals, of a calcium-magnesium-aluminium-silicate (CMAS) composition, are ingested into the turbine and deposited on the TBCs. Besides erosion, this also leads to degradation by chemical interaction.

The plasma spray-physical vapor deposition (PS-PVD) process is an advanced method for manufacturing TBCs, which fills the gap between traditional thermal spray processes and electron beam physical vapor deposition (EB-PVD). Due to the unique plasma conditions, coatings with columnar microstructures exhibiting high strain tolerance can be created. However, because of the high amount of open porosity the resistance of such structures to CMAS and erosion attack was expected to be low.

In the present work, PS-PVD TBCs were investigated in a burner rig facility under thermal gradient cycling conditions and simultaneous CMAS attack. The interactions of the PS-PVD-deposited YSZ and the CMAS melt were studied by means of scanning electron microscopy