CRACK MORPHOLOGY IN A COLUMNAR THERMAL BARRIER COATING SYSTEM

Anne Dennstedt, MINES ParisTech, PSL Research University, Centre des Matériaux, France; Institut für Werkstoff-Forschung, Deutsches Zentrum für Luft- und Raumfahrt, Germany
anne.dennstedt@gmx.com

Fabrice Gaslain, MINES ParisTech, PSL Research University, Centre des Matériaux, France

Marion Bartsch, Institut für Werkstoff-Forschung, Deutsches Zentrum für Luft- und Raumfahrt, Germany

Vincent Guipont, MINES ParisTech, PSL Research University, Centre des Matériaux, France

Vincent Maurel, MINES ParisTech, PSL Research University, Centre des Matériaux, France

Key Words: LASAT, FIB, EB-PVD, 3D morphology, crack tip

For high temperature application, EB-PVD ceramic layers are commonly used as thermal barrier coating. During thermal transients, the thermal expansion mismatch between coating and substrate drives failure of the TBC mainly by interfacial cracking. Laser Shock Adhesion Test (LASAT) provides stresses at the ceramic/metal interface enabling controlled interfacial cracking [1-2]. For achieving a clear understanding of the influence of local morphology on interfacial toughness, this study aims at characterizing the 3D morphology of a crack at the interface between metal and an EB-PVD TBC having a columnar structure.

Cracks were produced by LASAT. Surface infra red measurement yields to the localisation of the crack, that is detailed using cross-section, Fig (a) and (b) respectively. The crack tip was documented further in SE and BSE image stacks collected simultaneously during subsequent slice and view operations using a focus ion beam (FIB) and a scanning electron microscope (FIB slice & view). The segmented 3D data gives clear understanding of the columnar structure of the ceramic and of the interaction between the crack and the TBC microstructure, Fig (c).

References