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Thermal shock performance of carbon-bonded carbon fiber composite and ceramic matrix composite joints for thermal protection re-entry applications

K. I. Triantou[1], K. Mergia[1,*], B. Perez[2], S. Florez[2], A. Stefan[3], C. Ban[3], G. Pelin[3], G. Ionescu[3], C. Zuber[4], W.P.P. Fischer[5] and J. Barcena[2]

[1]*National Centre for Scientific Research "Demokritos", Athens, GR-15310, Greece*
[2]*Tecnalia Research & Innovation, Donostia-San Sebastian, E-2009, Spain*
[3]*National Institute for Aerospace Research and Development "Elie Carafoli", Bucharest, Romania*
[4] *German Aerospace Center (DLR), 70569-Stuttgart, Germany*
[5]*Airbus Defense & Space, Bremen, D-28199, Germany*

ABSTRACT

Hybrid thermal protection systems for aerospace applications based on carbon-bonded carbon fiber composite (CALCARB®) and ceramic matrix composites have been investigated. Two types of ceramic composite materials were considered, C_f/SiC (SiCARBON™) and C/C-SiC. The ablative material and the ceramic matrix composite were joined using alumina, graphite and zirconia-zirconium silicate based commercial high temperature adhesives and their performance on thermal shock tests was evaluated. Microstructural analysis of the joints after thermal shock tests was conducted using optical microscopy and scanning electron microscopy (SEM) coupled with energy dispersive spectroscopy (EDS). Both material combinations survive the thermal shock tests for the structures in which zirconia-zirconium silicate and graphite based adhesives were employed.

Keywords: A. Ceramic-matrix composites (CMCs), B. High-temperature properties, D. Electron microscopy, E. Joints/joining

* Corresponding author: email kmergia@ipta.demokritos.gr, tel (+30) 210 6503706, National Centre for Scientific Research Demokritos, 15310 Aghia Paraskevi, Athens, Greece