

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
New Materials and Structural Concepts (4)

Author: Dr. Luigi Scatteia
Booz and Company, The Netherlands, luigi.scatteia@strategyand.pwc.com

Dr. Davide Alfano
CIRA Italian Aerospace Research Centre, Italy, d.alfano@cira.it
Ms. Stefania Cantoni
CIRA Italian Aerospace Research Centre, Italy, s.cantoni@cira.it
Dr. Roberto Gardi
CIRA Italian Aerospace Research Centre, Italy, r.gardi@cira.it
Dr. Giuliano Marino
CIRA Italian Aerospace Research Centre, Italy, g.marino@cira.it

ULTRA HIGH TEMPERATURES CERAMICS FOR HOT STRUCTURES: LESSON LEARNED AND
FUTURE PERSPECTIVES

Abstract

Ceramic compounds based on metal borides, such as zirconium diboride (ZrB_2) and hafnium diboride (HfB_2) are usually defined Ultra High Temperature Ceramics (UHTC) for their extremely high melting temperatures. Of those UHTC, ZrB_2 has the lowest theoretical density (6.10 g/cm^3), which makes it an attractive material for aerospace applications such as sharp leading edges hot structures on future generation of slender-shaped re-entry vehicles.

In the past years, various technological projects have been carried out by CIRA in order to investigate the applicability of UHTC materials to the manufacturing of slender-shaped hot structures. These projects have dealt with basic materials characterization, as well as with engineering issues related to mechanical couplings of complex-shaped parts.

The material research culminated into the long-duration, ultra high temperature plasma-torch test of a small nose cone demonstrator, while the engineering activities led to the manufacturing of several structural parts and prototypes.

The objective of this paper is to provide an insight into all the pros and cons of the UHTC technology, as evaluated during CIRA's pluriennial research on this class of materials. Also objective of this paper is to give a consistent perspective on future research directions to foster a successful adoption of this materials in space applications.