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Towards the understanding of key properties of ultra-high temperature ceramics for hypersonic applications

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Ultra-high temperature ceramics (UHTCs) are promising candidates for hypersonic applications as a consequence of their high melting point, in excess of 3000ºC for ZrB_2 and HfB_2 UHTCs. The UHTCs community has traditionally focused on the development of more oxidation resistant UHTCs composites in the last decade as a consequence of poor oxidation resistance of monolithic UHTCs. However, hypersonic applications, such as in sharp nose cones (SNC) and sharp-leading edges (SLE), require a combination of high temperature capability and high temperature strength, whereas high thermal conductivity is particularly desirable due to greater thermal transport during exposure in high-temperature reactive environments, by conduction and radiation back to the environment. At last but not least, UHTCs components have to ensure the structural stability of the hypersonic vehicle and should be structurally stable under operating conditions. However, SiC-reinforced UHTCs are not structurally stable above 1800ºC in spite of being considered baseline UHTCs for hypersonic applications as a consequence of their high oxidation resistance compared to other UHTCs composites and concentrate more than 50% of the research articles on UHTCs. In addition, there is a lack of information about structural properties and deformation mechanisms active at high temperature of UHTCs. Therefore, there is a needing for the understanding of UHTCs structural properties to perform a new approach for the development of UHTCs for hypersonic applications, as it will be illustrated; Novel UHTCs components that maximize their structural stability and resistance in addition to its oxidation resistance.

Biography

Eugenio Zapata-Solvas has completed his PhD studies on the role of grain boundaries in the plasticity of advanced ceramics at the University of Seville in 2008. Then, he carried out Postdoctoral studies about physical and chemical properties of UHTCs at Imperial College London and about flash sintering of advanced ceramics at the University of Oxford. He is currently a Research Fellow from the Materials Science Institute of Seville working on high temperature physical properties of UHTCs and new technologies for ceramics sintering. He has published more than 20 papers in indexed journals.

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