

## O85 Multifunctional Ceramics for Aeronautical and Aerospace Applications

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### Abstract

In the areas of aeronautics and aerospace, ceramic composites play an essential and increasing role due to their superior performance and tailorable properties, exhibiting highly specialized mechanical, thermal, and electric features<sup>1</sup>. Their main applications include thermal protection systems (TPS), thermal barrier coatings (TBC), and dielectric barrier discharge (DBD) plasma actuators, both for instrumentation and control purposes<sup>2</sup>. This work reports the manufacture and characterization of three ceramic composites capable of fulfilling the *multifunctional ceramic* condition according to the aforementioned applications. Accordingly, MgO-Al<sub>2</sub>O<sub>3</sub> (MA), MgO-CaZrO<sub>3</sub> (MCZ), and Y<sub>2</sub>O<sub>3</sub> stabilized ZrO<sub>2</sub> (YSZ) are introduced for TPS, TBC, and DBD dielectric elements. To this aim, MA, MCZ, and YSZ ceramic composites were fabricated via a sequential process, encompassing the selection of raw powders and milling, die pressing, and sintering. Further, the samples were polished for surface optimization.

Overall, the results obtained, including mechanical (Young's and shear moduli, flexural strength, hardness, and fracture toughness), thermal (thermal conductivity and thermal expansion (CTE)), and electrical (dielectric constant) properties, report evidence that the developed ceramics show suitable multifunctional characteristics and therefore fulfil the aeronautical and aerospace demands for increased materials performances. The combined analysis of the Young's and shear moduli (Fig. 1a) with the CTE – the latter over a wide range of temperatures (Fig. 1b) – allows concluding that the cost-effective and widely used alumina appears suitable for bulk monolithic (TPS) and joint applications (TPS, TBC, and DBD).

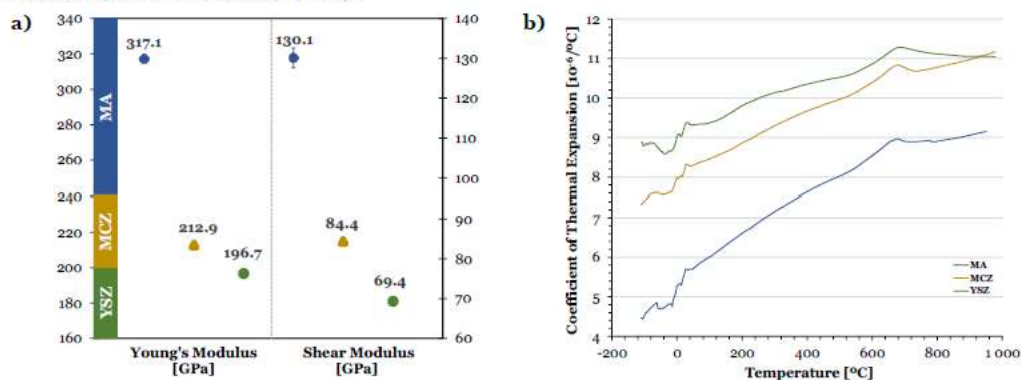


Figure 1. MA, MCZ, YSZ ceramic composites: a) dynamic Young's and shear moduli; b) CTE.

### References

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