PROGRAMME BOOK

ECerS2017

15th Conference & Exhibition
of the European Ceramic Society

July 9–13, 2017 / Budapest, Hungary

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ECerS2017

July 9–13, 2017, Budapest, Hungary

Jointly organised by the
Turkish Ceramic Society and the Hungarian Scientific Society of the Silicate Industry

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40 mass% of Ti-NbC is changing from ferromagnetic to diamagnetic at higher fields (up to 7T). At room temperature samples with 30 and 40 mass% of Ti-NbC are diamagnetic and the sample with 50 mass% of Ti-NbC is paramagnetic.

597

Characterization of thermal barriers coatings of Y-TZP/AL_2O_3/SiC composite obtained by suspension plasma spraying

V. Carnicer[1], E. Cañas[1], M.J. Orts[1], R. Moreno[2], M.D. Salvador[3], P. Carpio[3], L. Navarro[3], E. Sánchez[1]*

[1]Instituto de Tecnología Cerámica (ITC), Universitat Jaume I (UJI), Av. Sos Baynat s/n, 12006 Castellón, Spain; [*]e-mail: enrique.sanchez@itc.uji.es
[2]Instituto de Cerámica y Vidrio (ICV), Consejo Superior de Investigaciones Científicas (CSIC), Kelsen 5, E-28049, Madrid, Spain
[3]Instituto de Tecnología de Materiales (ITM), Universitat Politècnica de València (UPV), Camino de Vera, s/n, 46022 Valencia, Spain

Keywords: thermal barrier coatings, suspension plasma spraying, composite, self-healing

Thermal barrier coatings (TBCs) are used for protection of metals and ceramic components against corrosion, erosion and high temperature. The most common composition is based in yttria-stabilised zirconia (Y-TZP) because this material exhibits excellent mechanical and thermal properties. Nevertheless, continued use in extreme temperatures and aggressive conditions favours the appearance of cracks and the quick wear of the zircona layer. Hence, these TBCs must be improved in order to increase their lifetime under aggressive conditions. For that reason, the design of new TBCs with a self-healing functionality, which allows to increase the TBCs lifetime, could be an alternative challenge.

There are few ceramic materials with this ability, being silicon carbide (SiC) the most studied one. Nevertheless, SiC particles tend to decompose and oxidise inside a plasma torch losing their healing ability. The preservation of this ability is essential, thus, a new strategy has been followed in the present work in order to avoid the decomposition of the SiC. This strategy consists of employing a suspension as feedstock instead of powders. In this way, the solid material receives less energy during deposition due to solvent evaporation. Furthermore, the addition of a third compound (Al_2O_3), which helps to melt the matrix mixture, can make a further contribution to the protection of the SiC particles in the plasma torch.

In accordance with the proposed strategy, an aqueous-based suspension of SiC, Y-TZP and Al_2O_3 was prepared and deposited by suspension plasma spraying (SPS). The deposition was performed onto substrates of stainless steel, employing different solid contents and stand-off distances with the purpose of assessing coatings microstructure. The obtained coatings were microstructurally analysed by scanning electron microscopy (SEM) and energy dispersive X-ray (EDX), while the different crystalline phases were determined by X-ray diffraction (XRD). The characterisation reveals the presence of unmelted SiC particles dispersed in a

partially melted matrix of Al_2O_3/Y-TZP, confirming that the SiC particles have not been oxidised during plasma spraying, preserving its potential self-healing ability. Besides, the effect of stand-of distances on the coatings porosity and adherence was also assessed.

Acknowledgements
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Adhesion assessment of bioactive coatings deposited by atmospheric plasma spraying

Eugeni Cañas[*], Mónica Vicent, Mª José Orts, Enrique Sánchez*

Instituto de Tecnología Cerámica (ITC), Asociación de Investigación de las Industrias Cerámicas (AICE), Universitat Jaume I (UJI), Avenida Vicente Sos Baynat s/n, Castellón, Spain;
[*]e-mail: eugeni.canas@itc.uji.es

Keywords: bioactive powders, atmospheric plasma spraying, bioactive coatings, coatings adhesion

Bioactive coatings are used in the field of medicine as coatings for orthopaedic implants made of bio-inert materials such as stainless steel, chromium/cobalt or titanium alloys with the aim of conferring biocompatibility and protecting them against the corrosion and the degradation promoted by biological fluids. Usually, these coatings can be deposited by different techniques such as enamelling, sol-gel or dipping. However, atmospheric plasma spraying (APS) is one of the most studied and used method for obtaining these coatings. While bioactive coatings have to accomplish several requirements (biocompatibility, porosity, rough surface, etc.), a good adhesion to the implant surface represents one of the most important challenges which is hardly reached.

Therefore, the aim of the present work is to prepare bioactive coatings by APS employing different spraying parameters and substrates in order to model the adhesion of the coatings and to determine the best parameters that allow to prepare coatings with good adhesion to the substrate. For that purpose, a statistical analysis was performed evaluating the adhesion in function of different variables, each one at two different levels, and correlating the adhesion with them. The variables chosen are the argon flow and the feedstock feed rates, the type of substrate and the presence of a bond coat. Furthermore, coatings were microstructurally characterised by scanning electron microscopy and their nature (amorphous or crystalline) was determined by X-ray diffraction.

The obtained results show significant differences in coatings adhesion in function of the variables tested, varying this mechanical property from 0.6 to 10 MPa. Moreover, the model and the correlations between variables obtained from the statistical analysis, confirm that the adhesion is strongly influenced by the presence of a bond coat as well as the plasma gases flow rate and the type of substrate. Besides, it can be appreciated that coatings with higher adhesion values show better microstructures.

Characterization of thermal barriers coatings of Y-TZP/Al2O3/SiC composite obtained by suspension plasma spraying

V. Carnicer [1], E. Cañas [1], M.J. Orts [1], R. Moreno [2], M.D Salvador [3], P. Carpio [3], L. Navarro [3], E. Sánchez [1]

[1] Instituto de Tecnología Cerámica (ITC), Universitat Jaume I (UJI), Av. Sos Baynat s/n, 12006, Castellón (Spain)
[2] Instituto de Cerámica y Vidrio (ICV), Universidad Autónoma de Madrid, Kelsen 5 , E28049, Madrid (Spain)
[3] Instituto de Tecnología de Materiales (ITM), Universitat Politècnica de València (UPV),, Camino de Vera, 46022, Valencia (Spain)

Instituto de Tecnología Cerámica

1 INTRODUCTION

Thermal barrier coatings (TBCs) are commonly used for protection of metals and ceramics components against corrosion at high temperatures. The most common composition is based in yttria-stabilised zirconia (Y-TZP) due to its excellent thermal properties, and the bond coat is made of metallic alloy [1-2].

The aim of this work is to improve TBCs providing a self-healing ability. For that purpose, an aqueous suspension of SiC Y-TZP and Al_2O_3 was prepared and deposited by suspension plasma spraying to avoid the oxidation of self-healing agent (SiC). The coatings obtained were microstructurally characterization to confirm the state of the self-healing particles.

2 EXPERIMENTAL

Suspension preparation

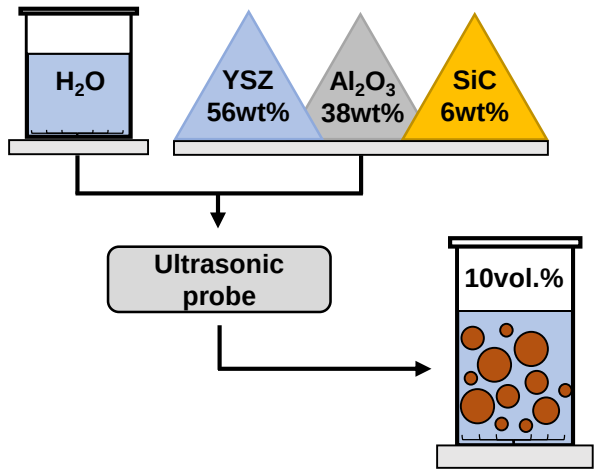

Figure 1. Preparation and dispersion of submicron suspension.

Table 1. Spraying parameters employed.

Plasma torch	F4-MB	Pre-heating temperature (ºC)	300
Ar flow rate (slpm*)	37	Injector diameter (µm)	150
H_2 flow rate (slpm*)	8	Injection pressure (bar)	6
Arc intensity (A)	700	Suspension feed rate (ml/min)	26
Spraying distance (mm)	50	Traverse speed (m/s)	1,25

*slpm: standard litres per minute.

3 RESULTS

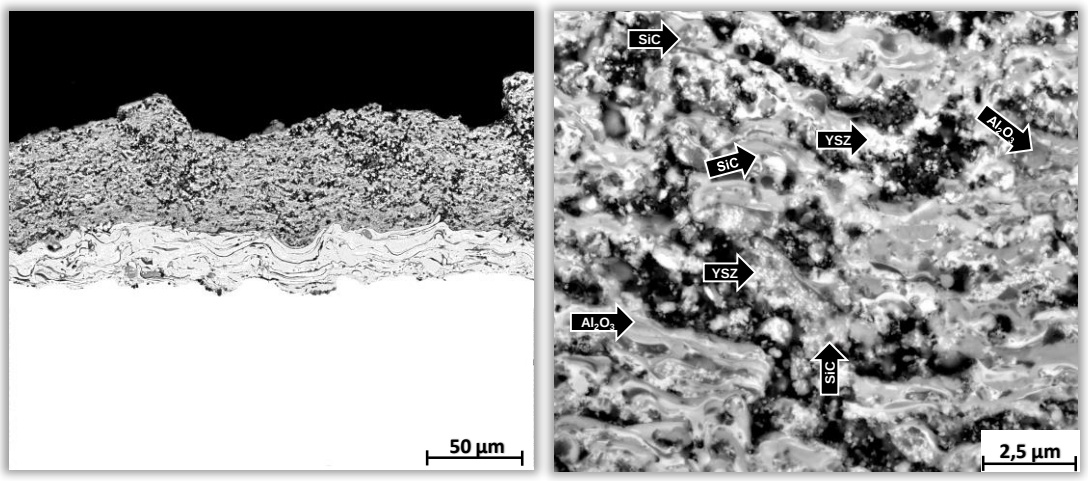

Figure 2. FEG-ESEM section micrographs of the SPS coating at two magnification.

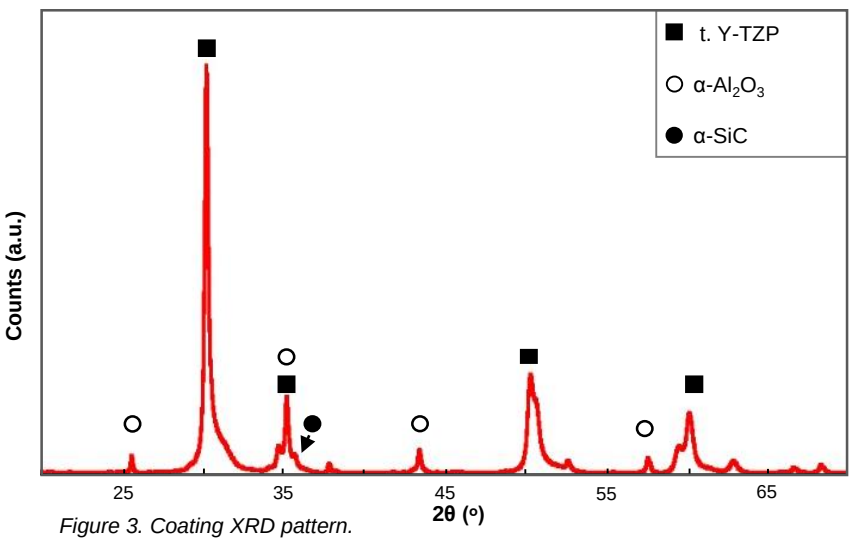

Figure 3. Coating XRD pattern.

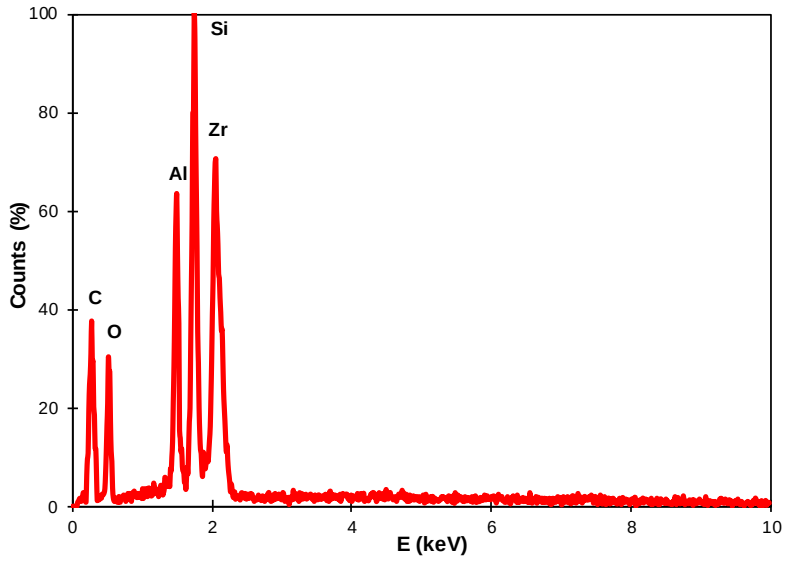

Figure 4. EDX analysis of particles with high content of silicon.

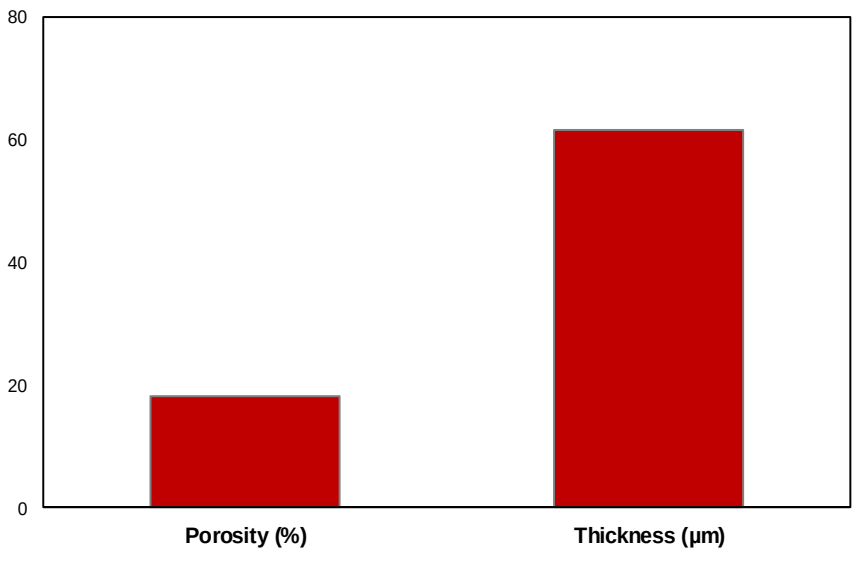

Figure 5. Porosity and thickness of SPS coating.

4 CONCLUSION

- An aqueous suspension of submicron YSZ, Al_2O_3 and SiC was successfully deposited by suspension plasma spraying.
- Particles with high content of Si and angular shape were identified in coating microstructure by EDX. XRD analysis confirms that these particles are SiC. Therefore, it can be stated that SiC particles have not been oxidised during spraying.
- It can be observed that, it is necessary to improve of deposition for to reduce the porosity and to increase the thickness of the coating.

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victor.carnicer@itc.uji.es