

# Improvement Microstructure and Hot Corrosion Resistance of Plasma Sprayed Thermal Barrier Coatings by 20%wt Al<sub>2</sub>O<sub>3</sub> Addition

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## Abstract

This study aimed to study effect of alumina addition to yttria partially stabilized zirconia on microstructure and hot corrosion performance of 20%wt Al<sub>2</sub>O<sub>3</sub> + YSZ composite thermal barrier coatings (TBCs) in the presence of molten eutectic mixture of Na<sub>2</sub>SO<sub>4</sub> + V<sub>2</sub>O<sub>5</sub> at 900 °C at different times are 1, 10, 40 and 80 Hrs. and comparison with conventional YSZ. The 20%wt Al<sub>2</sub>O<sub>3</sub> + YSZ composite coatings are prepared by atmospheric plasma spray (APS). Upper surface plan views of the coatings are examined using scanning electron microscopy (SEM) to observe the morphological and microstructural changes. Element analysis and phases are identified for both conventional and composite. The hot corrosion test products are determined using (EDS), (EPMA) and (XRD). The results indicate that the hot corrosion resistance of plasma sprayed TBCs is enhanced by laser addition of alumina. This enhancement due to reducing of specific reactive area of composite surface layer and consequently, decreasing the reaction between molten salt and zirconia stabilizers. In addition to elimination of the vertical crack and pores which are in conventional YSZ. SEM indicates that corrosion products have rod-like and semi cubic crystals in both type of coatings. In coating with alumina, these crystals are found fewer and smaller than conventional coating in terms of quantity and size. The semi-cubic crystals grow to needle like structure with increasing of time exposure to form numerous needles in glossy matrix at 40hours. The XRD patterns of conventional and composite coating before and after hot corrosion at different interaction time are clearly formed many extra new phases. The main phases before corrosion are metastable tetragonal phase (t') and resident of monoclinic phase (m) for conventional YSZ, while for YSZ+Al<sub>2</sub>O<sub>3</sub> composite are (t') and α-Al<sub>2</sub>O<sub>3</sub>. Corrosion products are m phase and vanadium compounds (YO<sub>2</sub>). The amount of m phase formed is less than the vanadium compounds (YO<sub>2</sub>). This observation suggests that during failure there are still high volume fraction of t' phase. Therefore, the low reaction rate of formation of YO<sub>2</sub> without reaching the m phase underneath plasma sprayed for composite coating and increasing the resistance of corrosion by alumina addition

## Biography

Ali Mezher Resen is a PhD student in Production Engineering for PhD and the thesis subject was laser Engineering and Metallurgy, University of Technology, processing and thermal barrier coating material, plasma Baghdad, Iraq. He is working as a Lecturer at the same spray . He has contributed greatly to the understanding of school where he is studying. He obtained his Bachelor's in surface engineering of materials and coating material. Also Metallurgy Engineering in 2004, and he got his MSc in he is a member in many scientific societies and has Metallurgy Engineering in 2008. He had studied Surface published many research articles in his field

