

3rd International Conference and Exhibition on Materials Science & Engineering

October 06-08, 2014 Hilton San Antonio Airport, USA

Study on stress relaxation behavior of glass-ceramic coating for its application as bond coat in a thermal barrier coating system

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Glass-ceramics have great potential to be used as bond coat in a conventional thermal barrier coating (TBC) system. It is already established that oxide based glass-ceramic bond coat can prevent bond coat oxidation induced TBC degradation. Further, glass-ceramic bond coat protects the metallic substrate of the TBC system from oxidation and creep failure due to its inherent low thermal conductivity. The stiffness of the TBC systems is an important parameter that assesses their brittle failure behavior. The low stiffness leads to low residual stresses in the system and high thermo-mechanical stability. In the present study, isothermal four point bend tests were carried out to determine the stiffness of the glass-ceramic coating-nimonic superalloy substrate systems from room temperature to 800°C in an instron machine. It was noted that at the room temperature load decreased to a very small amount for a certain deflection during unloading. The reduction in the load for a definite amount of deflection during unloading was significantly higher at higher temperatures due to stress relaxation effect wherein stress decreased with respect to time when strain was held constant at a fixed temperature due to structural rearrangements in the coating-substrate system, which take place more favorably at the elevated temperatures. Finally, stress relaxation effect was also studied in a TBC system comprising of 8 wt.% yttria stabilized zirconia (8-YSZ) top coat, glass-ceramic bond coat and nimonic superalloy substrate. It was quite evident that the stress relaxation occurred considerably in a glass-ceramic bond coated TBC system.

Biography

Sumana Ghosh has passed BE (Metallurgical Engineering) from Bengal Engineering College and Science University, Shibpur, Howrah, India. She has passed MTech (Materials Science) from Indian Institute of Technology (I.I.T.), Kharagpur, India. She has completed her PhD from Jadavpur University, Kolkata, India. She is a Senior Scientist of CSIR-Central Glass and Ceramic Research Institute (CSIR-CGCRI), Kolkata, India. She has published more than 25 papers in reputed journals and 20 papers in conference proceedings. She has 5 patents and three book chapters. She is a reviewer of some reputed journals.

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