Abstract

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Isothermal oxidation behaviour of glass-ceramic based multilayer functionally graded thermal barrier coating

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Abstract

Statement of the Problem: Usually, thermal barrier coatings (TBCs) are a duplex structure consisting of NiCrAlY/NiCoCrAlY based metallic bond coat and yttria stabilised zirconia (YSZ) based ceramic top coat. Researchers are looking to improve the conventional TBC system for long term high temperature application. A new approach has been taken by the researchers wherein the coating architecture is consisted of multilayer ceramic coatings having longer lifetime than conventional TBC systems.

Methodology and Theoretical Orientation: Novel multi-layer functionally graded TBC system was fabricated wherein conventional NiCrAlY/NiCoCrAlY bond coat material was replaced with glass-ceramics. Objective was to investigate isothermal oxidation behaviour of new glass-ceramic based multi-layer functionally graded TBC systems at 1100oC. Triple-layer functionally graded TBC systems comprising of nimonic alloy substrate followed by 100% glass-ceramic bond coat and glass-ceramic-YSZ functionally graded layer and 100% YSZ top coat was characterized after isothermal oxidation at 1100oC for 100 h.

Findings: Morphology of each layer of TBC system was distinctly changed after thermal exposure at 1100oC for 100 h. Phase transformation of t-ZrO2 to m-ZrO2 was also detected in the YSZ top coat after isothermal oxidation. No TGO layer was formed in case of glass-ceramic bond coated TBC system and thereby, enhanced reliability of the system. On the contrary, TGO layer was detected at the bond coat-top coat interface of the conventional TBC system.

Conclusion & Significance: The present study showed better performance of glass-ceramic based multilayer functionally graded TBC system compared to the conventional multilayer functionally graded TBC system. The study is very important in the present scenario as there is an ever increasing demand to increase the reliability of the TBC system for getting longer life time of coated components.

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Biography

Dr. Karthiga Parthiban has completed B.E. from IIEST, Shibpur and M.Tech. from IIT, Kharagpur. She has got Ph.D. degree from Jadavpur University, Kolkata. Currently, she is the Principal Scientist of CSIR-Central Glass and Ceramic Research Institute (CSIR-CGCRI), a premier research organization in India. She is working in the field of coating, joining and microwave processing of materials.

