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Experimental and numerical investigation on gas turbine blade with the application of thermal barrier coatings (Article)

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Abstract

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The engine parts material used in gas turbines (GTs) should be resistant to high-temperature variations. Thermal barrier coatings (TBCs) for gas turbine blades are found to have a significant effect on prolonging the life cycle of turbine blades by providing additional heat resistance. This work is to study the performance of TBCs on the high-temperature environment of the turbine blades. It is understood that this coating will increase the lifecycles of blade parts and decrease maintainence and repair costs. Experiments were performed on the gas turbine blade to see the effect of TBCs in different combinations of materials through the air plasma method. Three-layered coatings using materials INCONEL 718 as base coating, NiCoCrAlY as middle coating, and $La_2Ce_2O_7$ as the top coating was applied. Finite element analysis was performed using a two-dimensional method to optimize the suitable formulation of coatings on the blade. Temperature distributions for different combinations of coatings layers with different materials and thickness were studied. Additionally, three-dimensional thermal stress analysis was performed on the blade with a commercial code. Results on the effect of TBCs shows a significant improvement in thermal resistance compared to the uncoated gas turbine blade. © 2019 Techno-Press, Ltd.

SciVal Topic Prominence

Topic: Thermal Barrier Coatings | Aluminides | Superalloys

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Coatings | Finite element method | Materials | Plasma spray | Thermal analysis | Turbine blade

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