A Study on Prediction Model for Thermally Grown Oxide Layer in Thermal Barrier Coating

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Abstract : Thermal barrier coating(TBC) is applied for gas turbine components to protect the components from extremely high temperature condition. Since metallic substrate cannot endure such severe condition of gas turbines, delamination of TBC can cause failure of the system. Thus, delamination life of TBC is one of the most important issues for designing the components operating at high temperature condition. Thermal stress caused by thermally grown oxide(TGO) layer is known as one of the major failure mechanisms of TBC. Thermal stress by TGO mainly occurs at the interface between TGO layer and ceramic top coat layer, and it is strongly influenced by the thickness and shape of TGO layer. In this study, Isothermal oxidation is conducted on coin-type TBC specimens prepared by APS(air plasma spray) method. After the isothermal oxidation at various temperature and time condition, the thickness and shape(rumpling shape) of the TGO is investigated, and the test data is processed by numerical analysis. Finally, the test data is arranged into a mathematical prediction model with two variables(temperature and exposure time) which can predict the thickness and rumpling shape of TGO.

Keywords : thermal barrier coating, thermally grown oxide, thermal stress, isothermal oxidation, numerical analysis

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