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### “Measurement of topcoat thickness of TBC using terahertz waves”

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#### Abstract

Thermal barrier coating (TBC) is applied to high temperature components in gas turbine power generation, such as combustors and turbine blades, in order to protect the metal surface from a high temperature oxidizing environment. TBC consists of a ceramic topcoat and a metallic bondcoat. The topcoat thickness is an important factor which determines the thermal resistivity of TBC. In this report, a nondestructive, noncontact measurement technique of the topcoat thickness was developed. The technique is based on the time difference of terahertz (THz) waves reflected from the topcoat surface and the topcoat-bondcoat interface. A new method to measure the refractive index, which is necessary to obtain the thickness, was developed. The technique was applied to TBC specimens, and the results were in agreement with measurement results using a contact thickness gauge or microscopic observation of the cross section. The effect of the surface roughness was corrected based on the frequency dependence of the effective reflectivity and the frequency characteristics of the measurement device. THz measurement results of the topcoat thickness of TBC applied to a gas turbine blade agreed with microscopic observation results of the cross section to within 6%. The results showed that THz waves are effective for measuring the topcoat thickness, and that can be applied to in-service components.