



Time-domain Terahertz spectroscopy for non-destructive evaluation of thermal barrier coating on aircraft turbine blades

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Terahertz time-domain spectroscopy (THz-TDS) can be used for non-destructive evaluation (NDE) of various industrial materials like automotive paints, anti-corrosive coating and thermal barrier coating (TBC). The TBC on gas turbines and aero-engines usually consist of a ceramic top layer over a metal substrate with a bond coat in between them. The engine undergoes extreme thermal cycling and environmental degradation which causes various defects and wear in the TBC. Thermally grown aluminum oxide layer (TGO) will appear at the TBC to bond-coat interface. Also, the ceramic layer may decrease in thickness. TD-THz is an ideal NDE technique for the inspection of TBC and the detection of TGO. Here we present, a method to obtain the refractive indices, surface roughness and thicknesses of TBC and TGO layers, by analysing the THz waveform reflected from the TBC coated metal samples.

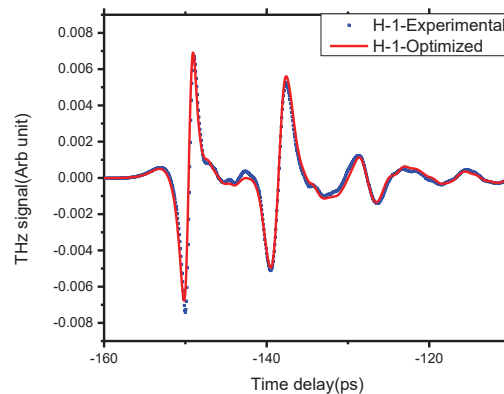


Figure 1. A Terahertz waveform reflected from a sample with a TBC layer of thickness $\sim 400 \mu\text{m}$ along with the best fit curve to the data.

I. J. White, G. Fichter, A. Chernovsky, J. F. Whitaker, D. Das, T.M. Pollock, D. Zimdars, "Time domain terahertz non-destructive evaluation of aeroturbine blade thermal barrier coatings" *Review of Progress in Quantitative Nondestructive Evaluation*, **1096**, 2009, pp. 434-439.