



**International
Standard**

ISO 21456

**Determination of the residual
stress of TGO layer in thermal
barrier coating by photoexcitation
fluorescence piezoelectric
spectroscopy**

*Détermination de la contrainte résiduelle de la couche TGO
dans les revêtements barrières thermiques par spectroscopie de
photoexcitation fluorescente et piezoélectrique*

**First edition
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Introduction

The thermally grown oxide (TGO) layer of a thermal barrier coating (TBC) is the fundamental cause of interface crack and eventual spalling failure of the ceramic layer. Therefore, the TGO layer and its interfaces with each layer are potential causes of TBC failure and peeling. The residual stress in the TGO of a TBC can be determined using the photoexcitation fluorescence piezoelectric spectroscopy (PFPS) method. This provides an important basis for the lifetime evaluation of TBC and to understand the failure mechanism of the TBC.

This method to test the residual stress in the TGO layer is a non-destructive testing method, unlike the curvature and drilling methods, which cause damage to the sample. Unlike x-ray diffraction, the penetration depth is only tens of micrometres.

The inclusion of Cr^{3+} in the TGO of a TBC is a prerequisite for testing the residual stress of the TGO layer of TBC by photoexcited fluorescence piezoelectric spectroscopy. No matter what method is used to prepare the TBC system, the bond coat contains a Cr element.

The size, shape and composition of the substrate material are not specified and differentiated. In addition, the preparation method of the TBC is not specified and differentiated.

The residual stress of the TGO layer is one of the main factors causing the failure of the TBC. However, no standard document is available for the test method process and the result of the photoexcited fluorescence piezoelectric spectroscopy test of residual stress in the TGO layer of the TBC. Therefore, it is necessary to develop a standardized and unified test method process that is conducive to the formation, simulation and testing of residual stress in the TGO layer of the TBC and even the prediction of the service life of the TBC.

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