

# COCOM.

Coating condition assessment of gas turbine blades and vanes.



## Background

Aluminum in a coating protects the base material from oxidation. Due to high temperatures and cycling of the gas turbine operations the aluminum oxide scale spalls off. New aluminum diffuses to the surface and forms a new aluminum oxide layer. This process continues until the amount of aluminum in the coating is too less to form a homogeneous closed oxide layer. This process strongly depends on the firing temperature of the gas turbine. Therefore, locations on a blade that are exposed to the highest metal temperatures will suffer the most from aluminum depletion.

By visual inspection it is not visible whether a coating gives enough protection or not. Only when the coating is oxidized completely or

disappeared, it may become visible at the surface. Blades may become too damaged with the consequence that oxidation and corrosion damage the base material. Parts need to be scrapped and costs for refurbishment increase substantial. This scenario can be avoided by applying the coating condition assessment service of KEMA.

One solution to reduce the thermal load on gas turbine blades and vanes is to provide blades with Thermal Barrier Coatings (TBC). The bond coating between TBC and base material should have the right properties to guarantee good attachment of the TBC. It also protects the base material from oxidation.

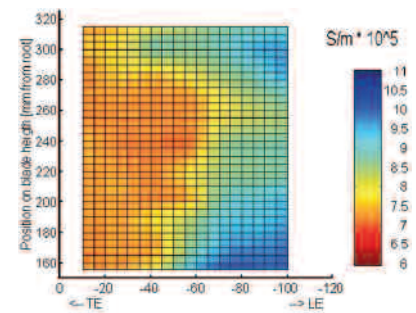
## Specification

The COCOM system works in a range from 100 kHz to 10 MHz in approximately 30 frequency steps with an Eddy current trans-



ducer driven by an oscillator detection module. At each frequency the impedance of the material is measured. The procedure is that apart from the blade under examination, measurements are made on two different conduction samples and at different lift off. This makes it possible to determine the normalized impedance. This means the impedance in the lift off free direction is independent of cables and transducer properties. A computer controls the transducer, stores and analyzes the test data. Measurements are made with the transducer just in front of the blade surface at different lift off positions.

The maximum thickness of the TBC allowed, to measure the bond coating quality is 550 micron. The maximum TBC thickness that can be measured is 1.5 mm. The accuracy for the coating thick-



ness measurements with COCOM is approximately 10%. However, more important is the calculation of the conduction.

## Case

Measurements have been made on a large number of blades and vanes from different types of gas turbines. Examples are: Alstom 13E2, GE Frame 9E, GE Frame 9FA.

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