

Non-destructive heat resistance evaluation system for TBC on gas turbine blade

Purpose:

To examine remaining life and appropriate recoating interval of blade, heat resistance of thermal barrier coating (TBC) on gas turbine blade can be measured by this non-destructive evaluation system.

Outlines:

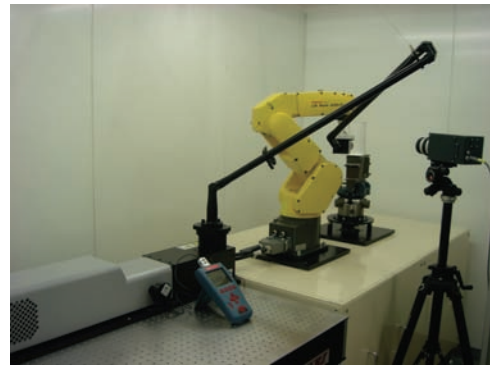
In recent years, with the demand for more efficient gas turbines, TBC has been applied to the surfaces of many hot gas path components such as blades. However, it has been reported that TBC degrades gradually in connection with coating loss and sintering. This system can measure the heat resistance of TBC non-destructively, being based on the principle that the surface temperature of degraded TBC decreases from its initial state. When performing the measurement, a thermography measures the temperature changes on the TBC surface heated by a carbon dioxide laser beam. The laser light is transmitted to the end of the robot arm through the multi-joint arm that has multi-mirrors on the inside, and the robot controls the location and direction of laser beam. This system is effective in evaluating TBC on intricate three-dimensional shaped blade surfaces.

Specifications:

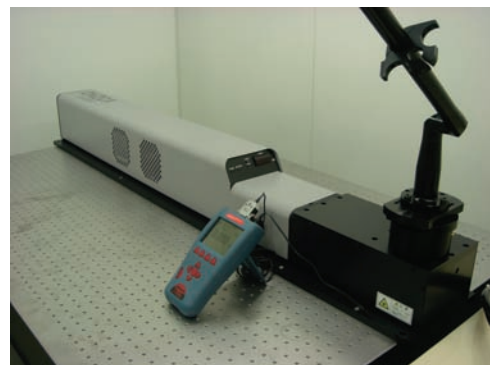
- (1) Robot
 - Six axes and one additional axis
 - Repeatability: $\pm 0.02\text{mm}$
- (2) Carbon dioxide laser
 - Wavelength: $10.6\ \mu\text{m}$
 - Power: $3\sim 40\text{W}$
- (3) Thermography
 - Detective wavelength: $3\sim 5\ \mu\text{m}$
 - Measurement temperature: $-40\sim 1200\ \text{deg. C}$
- (4) Multi-joint arm
 - Laser deviation in X-Y axes at arm exit: $\pm 0.5\text{mm}$

Location and date of installation:

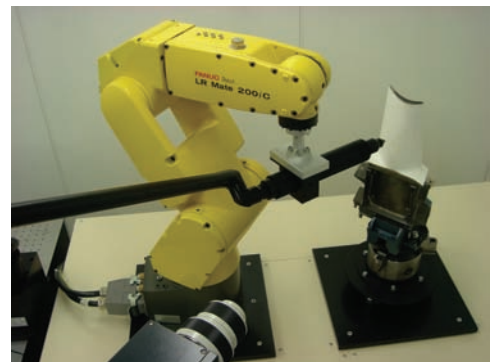
Yokosuka Area, March 2009



Overview of the system



Overview of laser part



Overview of measurement part