



EXPERIENCE AND CASE STUDIES

IN REPAIR OF GAS TURBINE HOT SECTION PARTS

Life extension of hot section parts by repair and refurbishment is today state-of-the-art and an important aspect in the economy of power generation. There follows some examples of case histories for consultancy services provided by Turbotect in the area of gas turbine metallurgy.

EXAMPLES OF CASE HISTORIES

Case history 1: Selection of alternative coating

Background:

A refurbishment shop offers a non-OEM solution for hot corrosion coatings to recoat repaired blades and vanes for GE Frame 9E gas turbines. The power plant has had some doubts as to whether the suggested alternative coating has equivalent properties and if it will negatively affect component life.

Consultancy expertise provided:

Most of the OEMs have their proprietary coatings which are not available to non-OEM refurbishment shops. As a result, non-OEM refurbishment shops are offering alternative coatings. Turbotect's in-depth knowledge and expertise in hot corrosion and oxidation resistant coatings enabled us to provide customized advice to avoid any negative influence on hot section part life of the alternative coating selected.

Result:

With the Turbotect expertise, the repair and recoating of the blades and vanes by the non-OEM workshop was possible without affecting the future component life time.

Case history 2: Metallographic investigation leading to a recommendation for an advanced coating

Background:

1st and 2nd stage blades and vanes of a Siemens-Westinghouse W-501 gas turbine fired on heavy fuel oil were attacked by hot corrosion after 6'000 operating hours and needed to be replaced and refurbished.

Consultancy expertise provided:

Metallographic investigations of parts, carried out by Turbotect, resulted in the recommendation for an advanced coating, taking into account the service conditions, the fired fuel and the operating experience. Blades and vanes coated according to the new specification enabled the operating hours to be increased to 18'000 hours between scheduled inspection/overhaul without any changes to the fuel quality, the firing temperature or in the dosage rate of the fuel additive.

Long term benefit:

Costs of approx. 600'000 USD, for gas turbine shutdown, 1st and 2nd stage blades and vanes replacement, refurbishment of blades and vanes were saved by extending to 18'000 operating hours, the interval between two scheduled major inspections, after modifying the specification for the coating according to Turbotect's advice and expertise.

Case history 3: Technical support in evaluation and selection of a refurbishment workshopBackground:

Transition pieces of a Siemens-Westinghouse gas turbine had to be refurbished and recoated with a thermal barrier coating. The selected refurbishment shop was only equipped with facilities for manual recoating (TBC) of the transition piece.

Consultancy expertise provided:

Problem identification: The achieved coating thickness distribution in the transition piece was not homogeneous and the resulting high temperature gradients in the transition piece were leading to cracks after 1000 operating hours!

Results:

Turbotect's wide experience enabled us to identify a coating shop, having the required automated facilities for the application of thermal barrier coatings to transition pieces. Thus, cracks in the base material could be avoided within the designed part life time.

Case history 4: Recommendation to change from slurry type to MCrAlY type coatingsBackground:

The power plant is firing heavy fuel oil. The 2nd stage blades and vanes were protected by a thin coating applied by slurry technology. The 3rd stage was uncoated.

The life time of these two stages was not sufficient and was the limiting factor for the time between overhauls.

Consultancy expertise provided:

In accordance to OEM philosophies, Turbotect recommended, the application of an MCrAlY type of coating for the 2nd and 3rd stage blades and vanes.

Thus, the life time of stages two and three could be drastically increased in spite of firing heavy fuel oil.

Long term benefit:

In this example and due to the extension of the parts life time after modification of the type of coating, an economic savings of approx. 300'000 USD resulted for the power plant.

Case history 5: Review of applied coating technologyBackground:

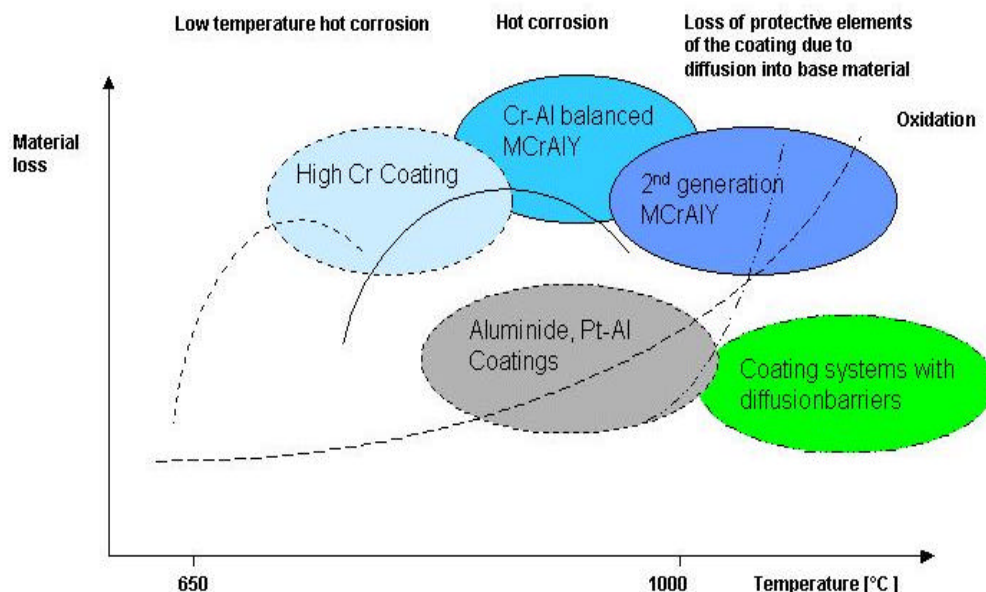
1st stage vanes of a gas turbine installed before 1990 and for peak load application were coated with first generation type of MCrAlY coatings.

Consultancy expertise provided:

Turbotect recommended the application of a thermal barrier coating (TBC) including a state-of-the-art MCrAlY bond coat. Due to the lower metal temperature and as a result of the thermal barrier coating, the life time of the coating could be doubled.

Long term benefit:

Costs of the order of 100'000 USD, for gas turbine shutdown, replacement and recoating of the vanes between two scheduled major inspections, have been saved after application of the thermal barrier coating on the 1st stage vanes.



Case history 6: Support and evaluation of coating shop, supervision of work and Q/C

Background:

A utility operating Alstom GT-8C gas turbines was seeking support and expert advice for the technical evaluation of tenders received for hot parts refurbishment work, for the selection of the workshop, and to supervise and control the quality of the work.

Consultancy expertise provided:

Expert review and technical evaluation of tenders. Technical support in the selection of the workshop. Alstom refurbishing shop was selected by the utility. Supervision of the refurbishment job by attending hold point meetings, meetings for scrap evaluation and quality control at the workshop after stripping and coating and before shipping of the parts.

Results:

Comments from the power plant management: We are very happy with the job Turbotect consulting service has done for us. We saved a lot of money and time for travelling and we think that by involving an expert having the background in coatings and refurbishment, the refurbishment shop and its subcontractors were pushed to supply their best quality and the parts were all ready to be installed according to the time schedule.

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