MITSUBISHI HEAVY INDUSTRIES COMPRESSOR CORPORATION

Mar. 7, 2012

CT-S-025 / 796-94437

Repair of damaged rotor journal portion

REASON FOR SUGGESTION:

A turbine rotor journal portion may have its surface damaged during operation about 0.3mm in depth for the maximum and the damage interferes with operation. The repair is highly desirable because the rotor is expensive and has long delivery time to do the replacement.

When the damage depth is lower than 0.2mm, repair can be done by chrome plating. But when the damage depth exceeds 0.2mm, plating thickness becomes 0.3mm, considering grinding margin. At this thickness, chrome plating becomes easy to flake off because of the increase in plating residual stress.

Conventionally, we have repaired deeply damaged rotor journal portion by under-sizing the journal diameter. However, interchangeability with the spare rotor journal bearing disappears for this case, and the customer will have difficulty in inventory control. Moreover, the necessity for stocking special sized bearing arises.

To avoid such a trouble, we researched repairing technology for the turbine journal portion that can be applied to the rotor with the blades installed.

As a result, we established the repair technology by High Velocity Oxygen Fuel (HVOF) coating.

DETAILS OF SUGGESTION:

The outline of repairing is as follows.

1) High Velocity Oxygen Fuel (HVOF) coating can repair damaged rotor journal portion without under-sizing the journal diameter.
2) Anti-erosion property of HVOF coating was verified to be better than base material.
3) Reliability of HVOF coated rotor was confirmed by actual loading test.

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Advanced technology for repairing rotor

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1. Repairing rotor

Scratch on bearing portion of rotor

- Depth < 0.2mm → Cr plating
- Depth > 0.2mm → Machining
  - Need special size bearing
  - Not compatible with spare rotor

↓

HVOF coating

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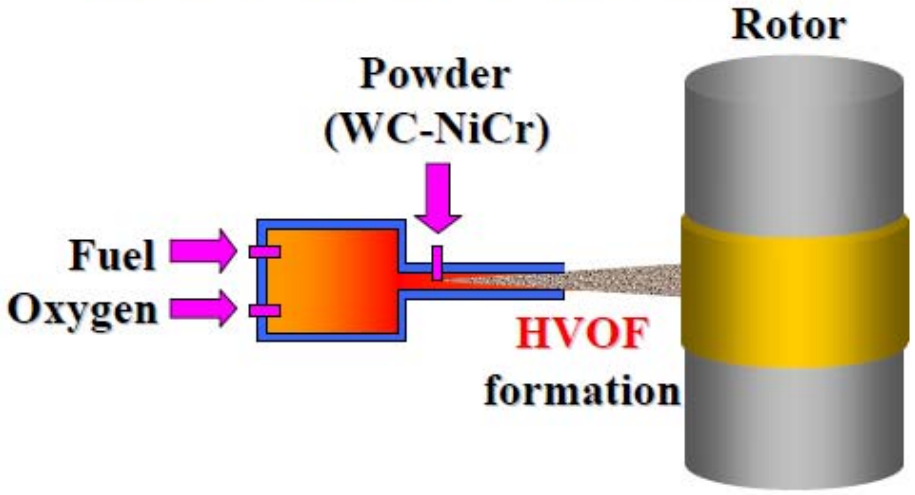
2. What is HVOF?

High Velocity Oxygen Fuel coating



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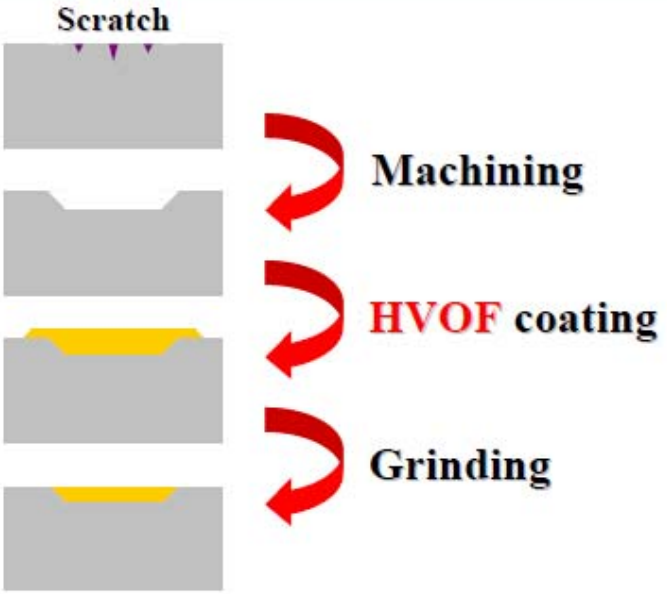
3. Procedure



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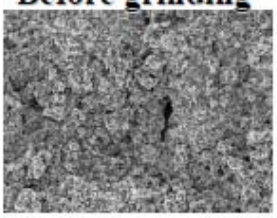
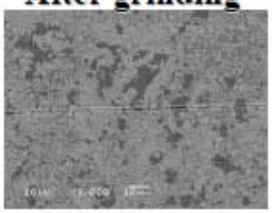
4. Quality

Surface

Before grinding



After grinding



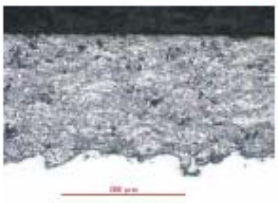
Roughness

$R_y = 1.2\ \mu m$

Hardness

Hv = 1000

Cross section



HVOF layer

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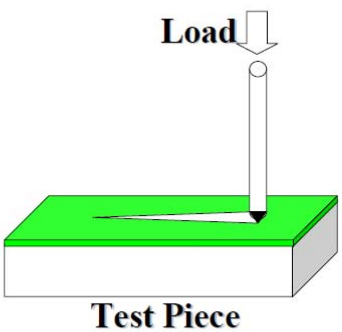
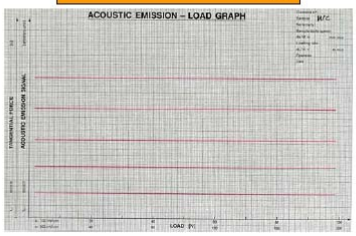
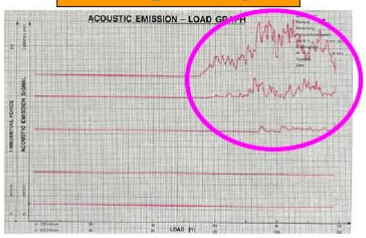
5. Scratch test



HVOF coating



Cr plating



Peeling signal

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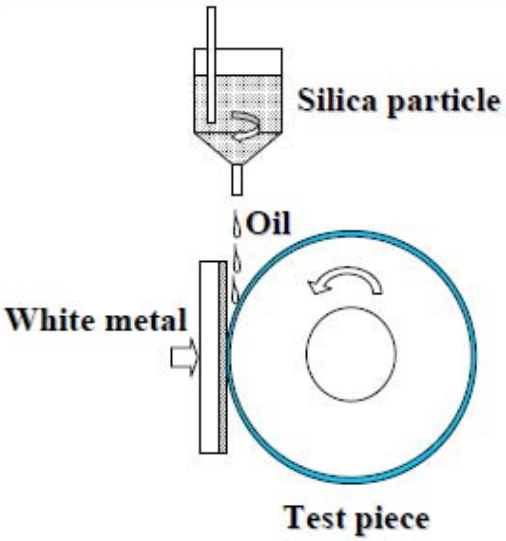
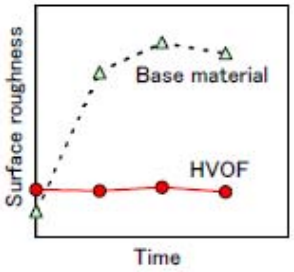
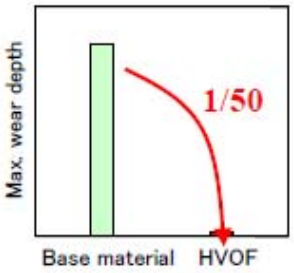
6. Erosion test







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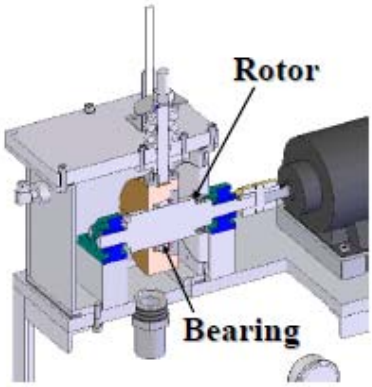
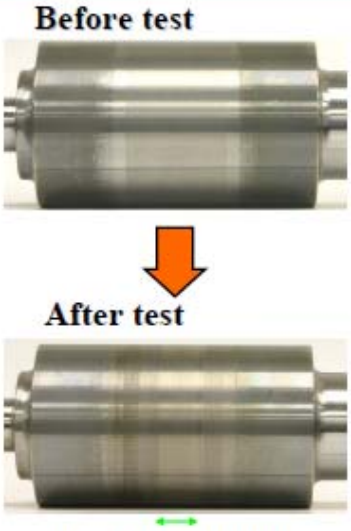
7. Endurance test



Reliability was confirmed under actual operating condition



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8. Summary

- HVOF coating can repair damaged rotor.
- Anti-erosion property of HVOF coating was verified better than base material.
- Reliability of HVOF coated rotor was confirmed by actual loading test.

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