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Thrust bearing with Ni-plating for ammonia plant

REASON FOR SUGGESTION:

Thrust bearing with copper alloy back metal is effective to decrease its metal temperature due to its good heat transfer performance as shown in separate technical seat (CT-S-023).

Temperature decrease of this copper alloy thrust bearing is confirmed actually for the machines in many plants.

On the other hand, copper alloy is known that it may be corroded in ammonia atmosphere (ammonium attack).

Therefore bearing pads with Ni-plated copper alloy back metal is newly developed for ammonia plant.

And this thrust bearing (copper alloy back metal with nickel plating) has good performance as same as that of original copper alloy thrust bearing.

DETAILS OF SUGGESTION:

The outline of improvement is as follows: (See the attached report)

- 1) Special Ni-plating was applied for copper alloy back metal to isolate it from corrosive atmosphere (ammonia).
- 2) Its heat transfer performance was confirmed to be as same as that of bare copper alloy.
That is, 20 ~30% of temperature decrease of thrust bearing will be expected.
- 3) Dimension is same with that of steel back off set type thrust bearing.

If existing thrust bearing is off set type, pads of this new bearing are changeable.

If existing thrust bearing is not off set type, assembly of this new thrust bearing is changeable.

Newly Developed Thrust Bearing with Ni-Plating for Ammonia Plant

1. Existing High Reliable Thrust Bearing

High reliable thrust bearing having following features has been applied for many plants, such as Ethylene Plant, to get more safety margin by decrease of bearing temperature.

- Non-Flood Type
- Copper Alloy Back Metal
- Off set Pivot
- Improved Leveler

In fact, actual operating data with installing this improved thrust bearing has shown around 20 °C decrease of bearing temperature.

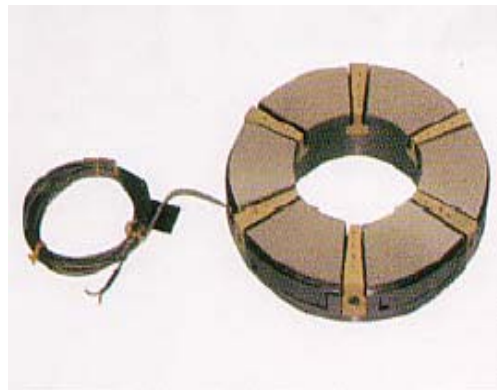
Copper alloy back metal is the most effective factor in this drastic temperature decrease.

But Copper Alloy has the possibility to be corroded in ammonia atmosphere.

So this bearing has not been recommended to apply in ammonia plant until today.



12 Pads
(for High Speed Turbine)



6 Pads

2. Newly Developed Thrust Bearing for Ammonia Plant

Special Ni-plating on copper alloy back metal of thrust bearing has been developed.

Surface of copper alloy back metal is isolated perfectly by applying Ni-plating from the ammonia atmosphere.

Therefore this new thrust bearing is applicable with high reliability for many machines in ammonia plant, even if lube oil contains ammonia gas.

In addition, optimum thickness of Ni-plating can keep the almost same heat transfer performance with that of original copper alloy metal



**Thrust bearing pads
(copper alloy back metal)**



**Thrust bearing pads
(copper alloy back metal)
with Ni-plating**

3. Test

Confirmation test was executed by MHI R & D in May,2004 and the successful data was obtained.

(1) Test Procedure

Following 3 kinds of test pieces were tested.

- ①: White metal + steel back metal
- ②: White metal + copper alloy back metal
- ③: White metal + copper alloy back metal with Ni-plating

White metal surface was heated and opposite side of the test pieces was cooled by water.

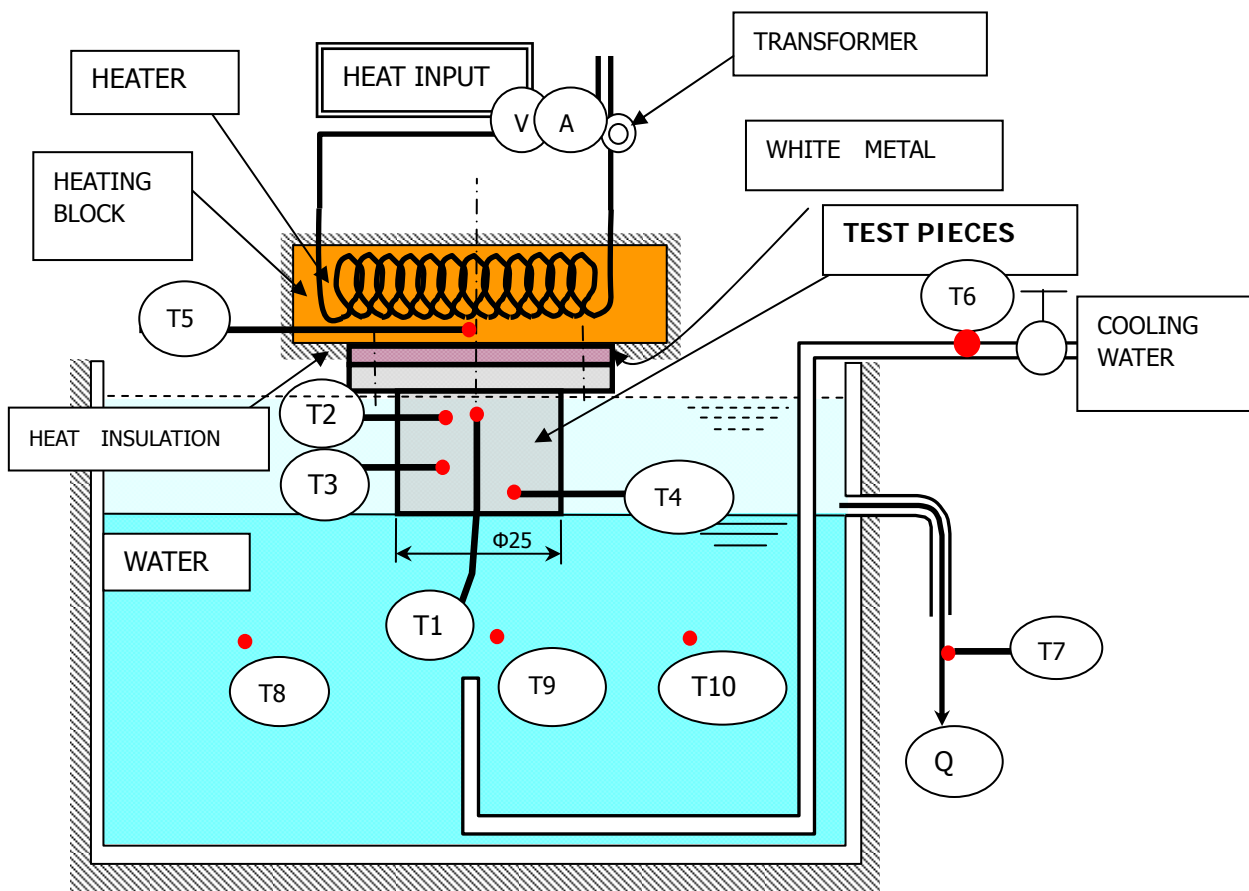
Temperature distribution was measured under this condition



Test piece ①

Test piece ②

Test piece ③



(2) Test Result

Same heat quantity to white metal was applied for each test pieces, and opposite side was cooled by the same cooling condition.

Distribution of temperature along the bar of each test pieces was measured.

The result is summarized in following table.

1) Steel back vs Copper alloy back with no plating

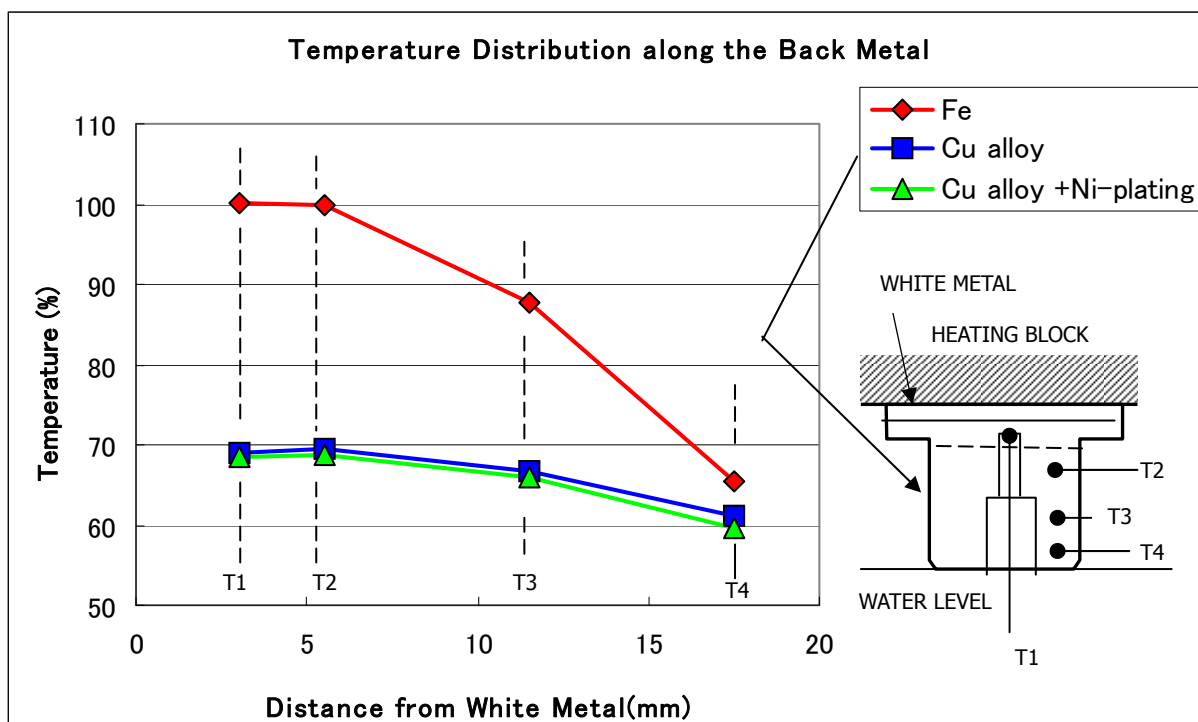
Temperature near white metal (T1, T2) of copper back bar have been approx. 30% lower than that of steel back bar. This result was the almost same result when installing the copper back thrust bearing instead of steel back thrust bearing in actual plant to get more safety margin of bearing temperature.

2) Copper alloy back with no plating vs Copper alloy back with Ni-plating

Temperature distribution of copper back without plating and copper back with Ni -plating are almost same.

It was confirmed that heat transfer performance did not deteriorate even after applying the Ni -plating.

The influence of Ni-plating on heat transfer performance was negligible small.





4. Conclusion

Improved thrust bearing, copper alloy back metal with Ni-plating, has been developed newly.

By applying Ni-plating, this bearing is possible to install even in the ammonia atmosphere, such as ammonia plant.

Its heat transfer performance was confirmed to be almost same with that of copper alloy back metal with no plating which have been already installed in many plant and have achieved the drastic decrease of thrust bearing temperature.