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PREVENTION OF SCALE ADHESION USING SURFACE TREATMENT OF COATING WITH ORGANIC COMPOUND AT GEOTHERMAL POWER STATION

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Key words Scale privention, surface coating, electrolytic polymerization

Abstract

Scaling problem at geothermal power station exerts an evil influence upon the power generation and the flow of terrestria hot water and vapor in the station. This work examined the clarification of scale formation mechanism and the prevention for scale formation by the surface coating of rotor with organic compound.

From observation results of rotor surface after working duaring one year, it is found that the coated surface only had a small amount of scale and that there are the traces of separation c scale, that is, the scale is easy to separate from this surface.

Therefore, this surface coating has the role of the privention of scale formation and the prolomgation of workable surface conditions.

1.Introduction

Thus far it is desired to advance the use of geothermal vapor and fluid as energy resources. But it is of urgent necessity to grapple with the scale adhesion problem in geothermal power station. For reference, Fig.1 shows a part of the rotor surface adhered with scale. The space between each blade is clogged with scale, whereas the scale causes the drop of generated output. This work examined the clarification of scale formation mechanism based upon the crystallization process [1)] and the prevetion for scal formation by the surface coating of the turbine rotor with organic compound by the electrolytic polymerization. This surface coating method was effective for the privention of scale formation .

2.Experiment

The part of turbine rotor used for coating is the half of th first stage impeller (SUS 410) . The coating method is as shown in the reference[2)] . As shown in Fig.2, The turbine rotor which blaste with dry sand, was dipped in the reactor (about 1.0 m^3) filled with an organic compound solution, which was kept at constant temperature, concentration and viscosity. Then the surface was coated with organic compound by the electrolytic polymerization with constant current density and time. After this treatment, the rotor was taken out from the reactor and the surface was washed quickly with water and then distilled water, and dried with air blow. The assessment of the surface coating was performed by the repelling examination. The completion of surface coating was udged according to the existence of the many fine drops of water on the surface as shown in Fig.3. Then this rotor was assembled into the turbine cassing.

3.Results and Discussion

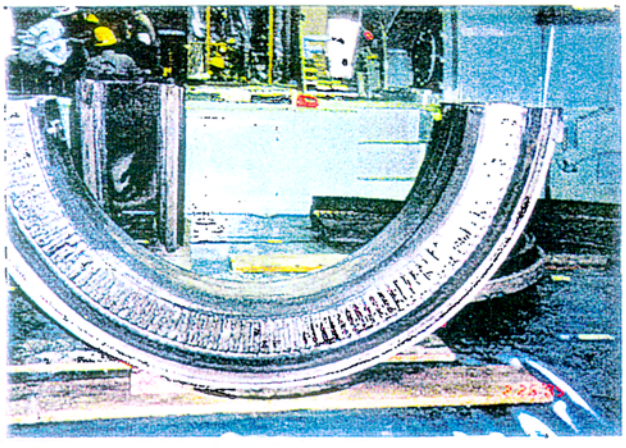
Fig.4 shows the coated rotor surface (a) and uncoated (b) removed from the turbine cassing after operation of one year. The amounts of scale is obviously larger on uncoated rotor surface than on coated one. The morphology and amounts of scale at the edge of the blade show a similar tendency discribed above as shown in Fig.5. The uncoated surface (b) has rich massive form. Some parts show that the space blades is plugged with scale. On the other hand, the scale on coated surface has small amounts anc smooth surface. Also the situation of the hidden side has similar tendency with that of the surface side. To mention particular features, the coated surface has many areas of the ground surface i.e. the scale come off and the base material of rotor is exposed as shown in Fig.6 . This situation suggests that the scale is easy to come off from the coated surface than the uncoated one.

4.Conclution

The coated surface with an organic compound in this work only had a small amount of scale and there are the traces of separation of scale after operation of one year. Therefore, the surface coating method in this work may have the role of the privention of scale formation and the proongation of workable surface conditions.

References

1) Mullin, J. W. ; Crystallization, 2nd ed, Butterworth, London, England (1972)
2) K. Mori et al. ; Electrochemical polymerization of 2-(dioctylamino)-1,3,5-triazine-4,6-dithiol on iron plates, Langmuir, 11(5) 1431-1434 (1995)



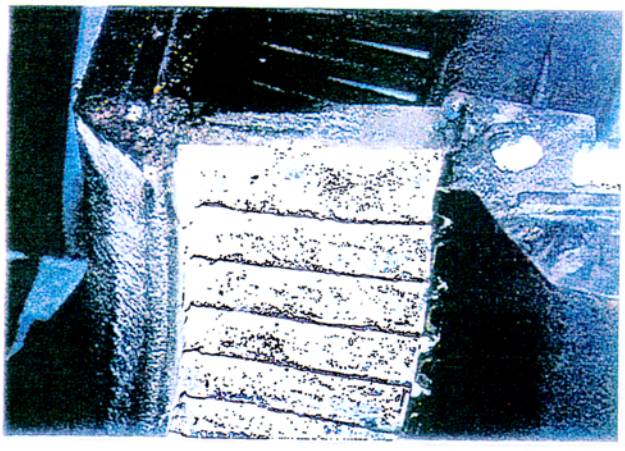


Fig.1 A part of the rotor surface adhered with scale.

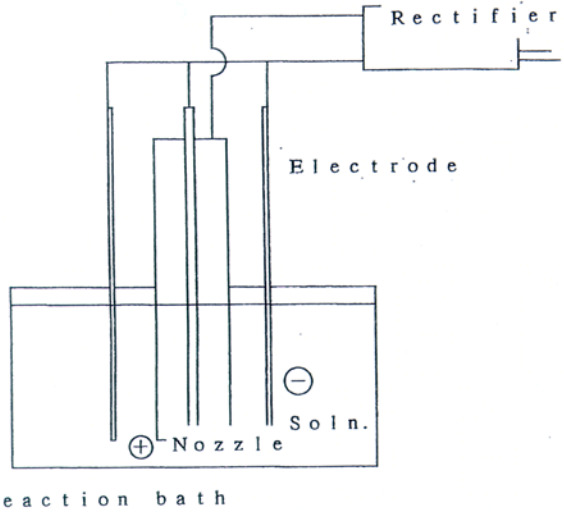


Fig.2 Experimental aparatus for surface was coated with organic compound by the electrolytic polymerization.

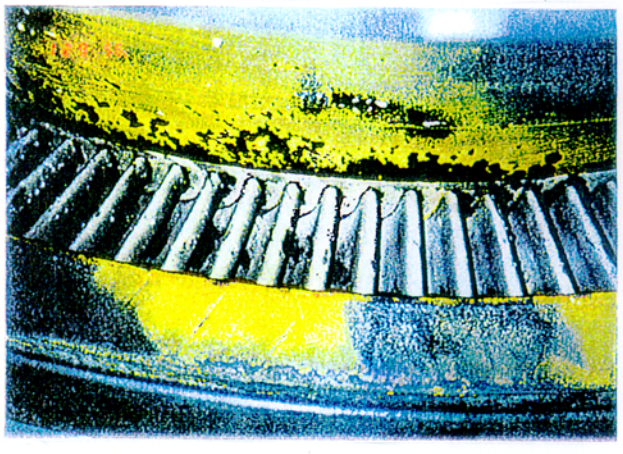
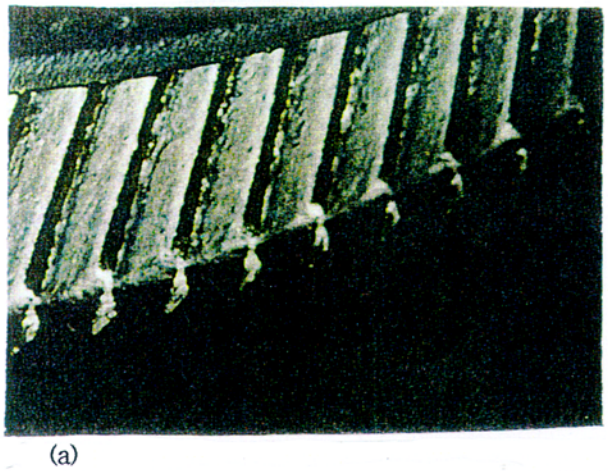


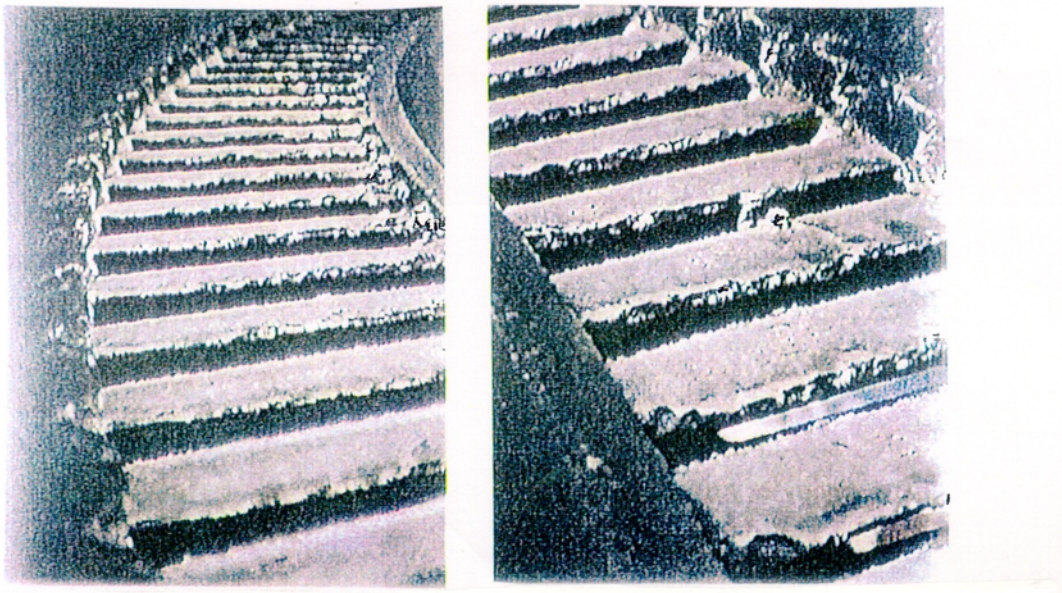
Fig.3 The coated surface with many fine drops of wate for repelling examination.



(a)

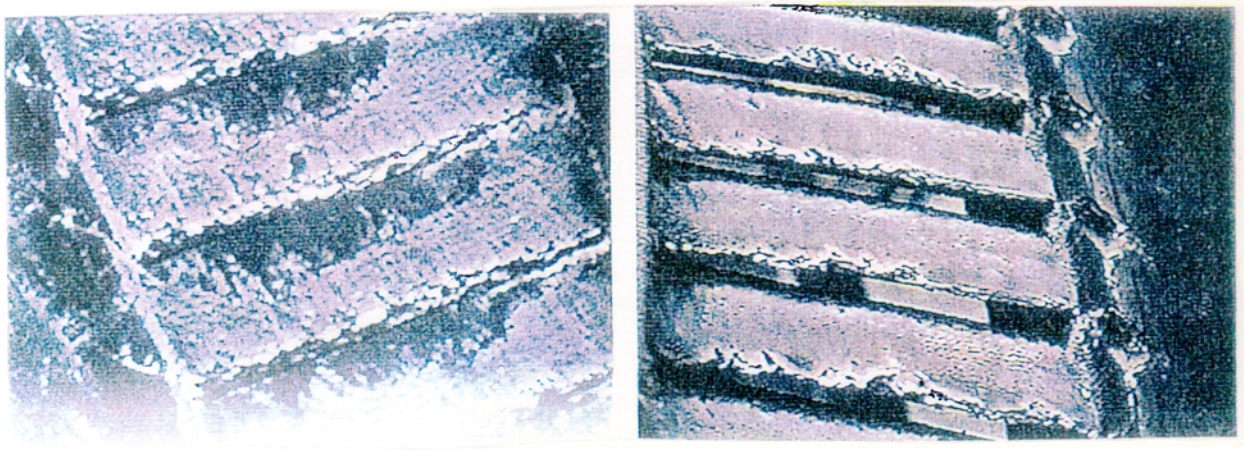
(b)

Fig.4 The coated rotor surface (a) and uncoated (b) removed from the turbine cassing after work during one year.



(a) (b)

Fig.5 The morphology and amounts of scale at the edge of the blade with the coated surface(a) and uncoated(b).



(a) (b)

Fig.6 The area of the ground surface with coated rotor. The uncoated surface has not one.