Proc. 12th New Zealand Geothermal Workshop 1990

ANTICORROSIVE COATING USED ON THE SHAFT OF GEOTHERMAL DEEP WELL PUMP

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ABSTRACT

On the basis of laboratory working, two series of coatings have been applied to the geothermal well pump in order to prevent the pump shaft from the uniform corrosion, galvanic corrosion and corrosion fatigue in the geothermal water. Through one year's experiments, it was found that the service life of the geothermal pump shaft can be .prolongedby using the proper coating.

INTRODUCTION

In some low temperature geothermal well of the 'Tianjin area, the conteut of chlorion in the water is high, reaching 900 ppm, and H_2S and NH_3 are existed. On these conditions, serious uniform corrosion and localized corrosion are occured through one year's running of the geothermal pump shaft. The material of shaft is No.35 Steel(C 0.32-0.4%, Si 0.17-0.37%, Mn 0.50-0.80%). The form of localized corrosion include galvanic corrosion and corrosion fatigue. In order to solve the problem, the research work on anti-corrsive paints was carried out. It was attemped that the coating protect the easily machined and cheap steel shaft against corrosion. First, two series of coatings were developed in the laboratory scale, after painting and curing the physical properties and the property of anti-corrosion in geothermal water were tested, the results were satisfactory. Further the two series of paints were applied to the geothermal well pump shaft. Through one year's experiments, it was found that the coating is still in good condition, the service life of the pump shaft was prolonged.

EXPERIMENTAL

Materials

The geothermal pump shaft rotates at very high speed while working, so the coating used on the shaft is required to resist wear besides corrosion, water and heat. In addition, the price of paint and the technology of painting (eg. curing at room temperature) were also considered. The compsition of epoxy paint and chloro-sulfonated polyethylene paint have been developed to meet the above demands.

Technology of painting

specimen: steel bar ⌀ 13x120mm, sheet steel 50x120mm, 1 mm thick, sheet tinplate 50x100mm.

Pump shaft ⌀ 26x2500 mm

The specimens and the pump shaft ere removed from rust by manual grinding with abasive paper until gray metallic luster appears on the surface, deoiled with acetone or xylene and air dried.

The paint was required to cure for half an hour after having been make up, then painted under the condition of relative humidity lower than 65%; Curing time is about 24 hour, total five coatings.

Techniques used for characterization

Model 7504 coating measuring gauge was used for measuring the coating thickness. QGS dry test appearance was used for judging the degree of dryness. QFD adhesion appearance, for adhesion specimen:(sheet tinplate), QCJ coating impact appearance for impact strength (specimen: sheet steel). Steel bar was settled in experimental loop of Tianjin University No. 2 geothermal well to test the anti-corrosive property of coatings in the geothermal water. The pump shaft was installed in Tianjin University No. 2 geothermal well.

RESULT AND DISCUSSION

The thickness and physical property of the coatings are shown in Table 1

Table 1 The thickness and property of coatings

No	name of paint	adhesion (class)	impact Kg.cm	number of coat	thickness um
1	epoxy paint	1	50	5	150-200
2	chlorosulfonate polyethylene paint	2	40	5	130-170

As shown in Table 1, the physical property of the coatings are fine. This is mainly decided by the special molecular structure of base in the paint.

The steel bar was sttled in experimental loop of Tianjin University No. 2 geothermal well for 18 monthes, the coating was in good condition. The fin anti-corrosive property of coatings can be atributed to not only the base material of the paint but also pigment. Certain aigment and filler can improve some property of coating.

The pump shafts before, after experiment were shown in the follow Figures.

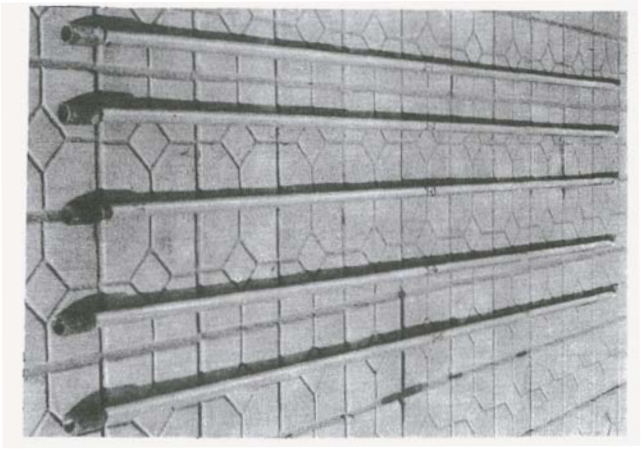

Fig.1: Shafts coated with epoxy paint (before experiment)

Fig. 1,2 show respectively the pump shafts coated with epoxy paint and chlorosulfonated polyethylene paint (before experiment).

Fig. 3,4 show the pump shafts having worked for one year in the geothermal well.

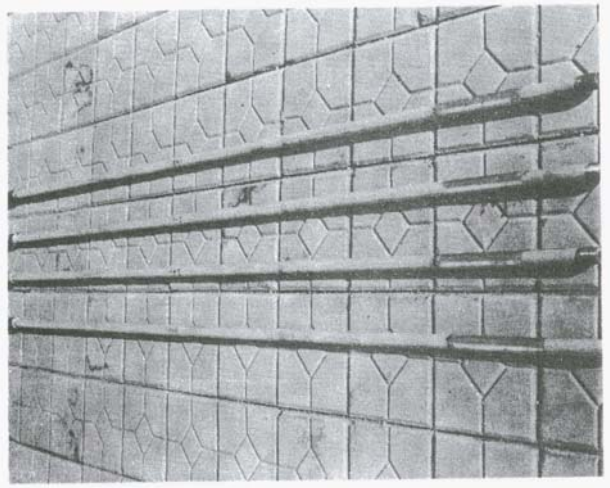

Fig.2: Shafts coated with chlorosulfonated polyethylene paint (before experiment)

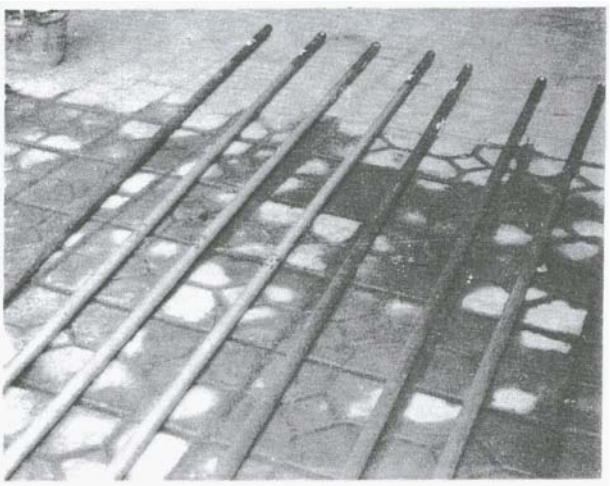

Fig.3: Shaft coated with epoxy paint (after one year's experiment)

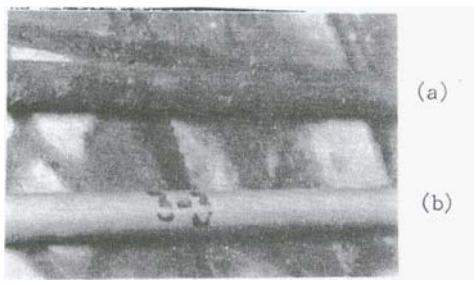

Fig.5: Shafts having worked for one year in the geothermal well
(a) not protected with coating
(b) protected with coating

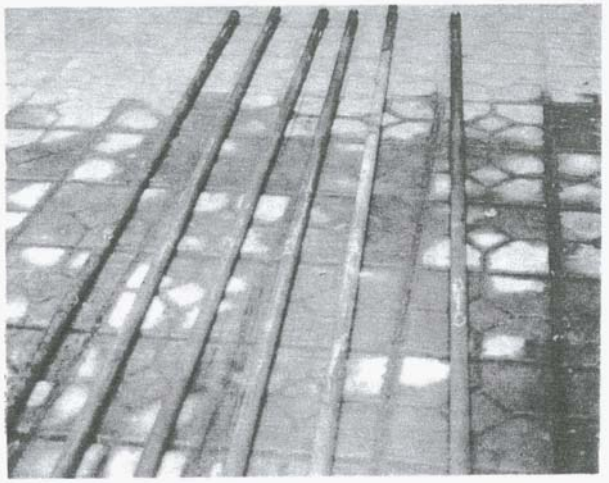

Fig.4: Shafts coated with chlorosulfonated polyethlene paint (after one year's experiment)

'It was found that the coating was still in good condition after one year's experiment. Only a very thin layer of scale deposited on the surface of some pump shafts. The pump shaft marked 0-0 was not protected with coatings.

Fig. 5 show two pump shafts, one was protected with coating and the other wasn't. At here, the action of coating was very obvious.

In addition, the series compositions of epoxy pint and chlorosulfonated polyethylene paint were developed and planed to apply in pipes and heat-exchangers. It will be our further work.

It should be paid attention that the surface treatment and the technology of painting play the important action to the property of coating.

CONCLUSION

Through one year's experiment, it was found that epoxy paint and chlorosulfonated polyethylene paint can be used to protect the geothermal pump shaft against corrosion, the service life of the geothermal pump shaft was prolonged. The measure that the proper coating protect steel material is one of the valid and economic method in the geothermal use.