

# REPLACEMENT TECHNOLOGY AND APPLICATION OF TITANIUM HEATING PIPE

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For many years, the fouling of heater block is an important problem puzzled salt making industry all the time. Because of various reasons, many salt making enterprises can not get rid of the problem of fouling of heater block, which makes the exchanging area of salt making reduces continuously, the output is directly influenced and the increase of producing capacity is baffled, which becomes a big difficult problem of salt making industry, therefore, the technological modification for heater dead pipe is necessarily. Aiming at the heater in Ti10 of effect I, our company adopts replacement process for parts to go on technological modification and it gains good achievement.

## 1 SITUATION OF THE FACILITIES

The 300,000 t/a of vacuum salt making facility in our company was put into production and successful in 1992. Since the production, for pursuing the effective production time, the period for evaporator washing is delayed, additionally the Dashanpu mine area belongs to evening exploitation and the impurities of the raw brine are higher, the heater scaling block is grievous in the process of production, especially the heater in Ti10 of effect I, because of running in super temperature for a long time, 85 roots pipes of heater is blocked and of the heating area of first effect is reduced by 5.8%(64m<sup>2</sup>). Through serious analysis, the artificers of the company make a preliminary judge that the super temperature in a long time leads to the metallographic changes of the heater. In the check and modification of washing the pipes, because of adopting the unscientific and irrational measures and tools, it makes the perforation of heater about the flower board of the top, and there are two kinds of perforation: first is the corrode perforation; second is the bulging break by hitting pipe. After that, the reduce of pressure in first effect is adopted to produce and scientific and rational methods and tools are adopted in washing evaporator and hitting

pipe, which makes the heater block gain effective control.

## 2 SCHEME OF TECHNOLOGIC MODIFICATION

In order to quietly solve the problem of reduce of exchanging area of heater in effect I which leads to the bottleneck of production and ensure the working period of construction and the quality after the modification of replacement, our company decides to adopt the method of replacement pulled by winding pipe in the heating pipe of the heater in Ti10 for parts modification through several consultation and technologic modification with repairing company and plenty argumentation.

### 2.1 Principle of pulling pipe

Firstly, to reduce the friction  $f=\mu N$  which forms by the heater and clad plate in the process of pulling, and to reduce the  $N$  value in order to control the production of bigger friction.

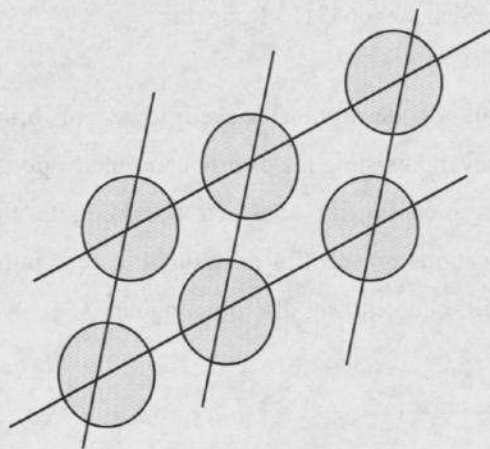
Secondly, to make use of that the friction is in direct ratio with attraction between molecules, the molecule attraction is in direct ratio with molecule contacting logarithm, the molecule contacting logarithm is in direct

ratio with contacting area, and the relation between friction and actual contacting area is linear:  $F = nRGm_1 \cdot m_2 / R^3$  (F—molecule attraction, N; n—molecule contacting logarithm;  $m_1$ 、 $m_2$ —molecule weight, Kg; G—constant; R—molecule distance, m)

Thirdly, the stronger of adhering key forming by the hanging key of the surface of metal and the surface of interface is, the bigger of the power that must be conquered in gliding, therefore the bigger of the friction coefficient is.

## 2.2 Phase of implement

(1) Hole distance between the heating pipes of heaters



(2) To use tools to clean the top of the pipes.

(3) According to the modification process of the phase of implement, to tear pipes, wrap pipes and pull pipes and 72 heating pipes are pulled out.

(4) According to the requirement to insert new pipes, and according to the process requirement of titanium welding, to weld the argon arc after cleaning the pipes and welding mouth of flower board, and the replacement of 63 pipes is successful and 47.25 square area is added effectively.

## 2.3 Problems in process of pulling pipes

In order to ensure other heaters will not be damaged in the process of tearing pipes and the favoring construction, the issues must be specially paid attention to:

(1) The high temperature in tearing the

pipes will easily lead to the distortion of close pipes, therefore the measures of ventilation and temperature reduce should be adopted;

(2) The material of pipes loses plasticity and becomes very easily crisply because the heating pipes are in high temperature for a long time, therefore, the bearing power for pipes in pulling pipes should be symmetrical and upright.

(3) The heat expand will makes the pipes be distorted and bigger, which will lead to the new pipes can't be inserted after pulling pipes, therefore the measures for fixing the pipes must be adopted.

## 4 Check

(1) According to the assess standard of appearance quality of welding titanium material, to check all of the welding mouth for eligibility.

(2) To test the whole water pressure of heater (pressure of test is 5kg), to check the welding quality for eligibility.

## 3 TEST FOR RUNNING AND BENEFIT

Through the test for running, the pipes of replacement have run safely for half a year and any quality problem is found. To add the heating area:  $S = \pi R^2$  and to add effective heating area 47.25 m<sup>2</sup>; Combining with other related technologic modification, according to the unit area output 14kg/m<sup>2</sup>h of our company at present to account the annual adding output  $G_1 = S \cdot h \cdot G_2 / 1000$  (S—heating area m<sup>2</sup>, h—effective producing time of whole year h,  $G_2$ —salt output of unit time and unit area kg/m<sup>2</sup>.h), it can increase the output for about 5,200 tons, which creates better economic benefit and social benefit.

## 4 CONCLUSIONS

The pipes of replacement of heater in first effect of our company has run safely for half a year till now, which not only solve the problems of super temperature in first effect and increase the capacity of absorbing steam, meantime but also increase the heating area of system, improve the process parameter of production, increase producing capacity greatly and quietly solve the bottleneck problem in the production. The replacement of pipes of heater gains good effect and better economic benefit, which starts the replacement of parts of titanium heater in salt industry.