Advanced Materials Research Vols 217-218 (2011) pp 774-776 *Online: 2011-03-30*

doi:10.4028/www.scientific.net/AMR.217-218.774

Study on a New Formula for Rust Remover *

Wang Xianghong

Department of chemistry and chemical engineering, Yangtze normal university, ChongQing, China

wangxhgg@163.com

*Fund Project: the Key Research Project of Chongqing（CSTC2010);the Key Research Project of fuling disrict, Chongqing（2009-1-13）

Keywords: New type, Rust remover, Formula

Abstract. The problem of steel products corrosion is increasingly outstanding, which causes a serious waste of resources. This thesis focuses on the study of a new formula for rust removing, adding some additives such as, corrosion inhibitor, complex agent, surfactant into the acid liquor, which is able to remove the rust layer effectively and protect metal products, economic and applicable. Through many testing on different ratio of additives composition, we obtain the optimal formula.

Introduction

With the development of world steel industry and steel manufacturing industry, steel products rust issue is becoming more and more serious. The total weight of the waste metal materials and equipments on corrosion in the world is large, which occupied 20%-30% of the annual total product. In our country, we suffered losses for hundreds of millions of dollars because of steel rust [1]. Before any anticorrosion measures we should take on metal products, it is necessary to remove rust in the process for removing corrosion products and resuming the function of metal devices and components. We usually use chemical cleaning method pickling process [2-6] to remove rust, but the polluted air is involved during pickling process, which leads to repeat the cleaning for many times. Therefore, the most important thing is to seek a high-effective and optimal rust removing technology to overcome the current inadequacy and shortcoming in pickling process. We add some additives such as, corrosion inhibitor, complex agent, surfactant into the acid liquor and optimize the solution proportion, which reach a good result for rust removing.

Experiment part

Laboratory Instrument and Reagent. Reagent: concentrated HCI; urotropine; sodium benzoate; triethanolamine; lauryl sodium sulfate; EDTA; OP emulsifying agent; oleic acid.
Instrument: beaker; graduated cylinder; glass rod; electronic balance
Test Method. Through phenomena observation and quality measurement, we can gradually find the optimal proportion and dosage of rust remover by means of screening on different proportion.

Experimental results and discussion

The Optimal Concentration of HCI and Treatment Time. The over concentration of HCI will cause over etching on metal surface, and its heavy acid mist is detrimental to the working environment and operators health [7]. The test shows that the optimal concentration of HCI is 30%, and the best treatment time should be about 8 minutes. (see table 1 and table 2)

Table 1 The rust removing results of different concentrations of HCI

HcL (%)	20	25	30	35	40
weight before rust removing(g)	21.6876	21.7982	21.5980	21.4973	21.6297
weight after rust removing(g)	21.5916	21.7107	21.4953	21.4069	21.6297
weight of removed rust(g)	0.0960	0.0875	0.1027	0.0904	0.0842

Table 2 The optimal treatment time

time	weight before rust removing (g)	weight after rust removing(g)	weight of removed rust(g)
2min	22.1560	21.9795	0.1765
4min	20.5306	20.3279	0.2027
6min	21.8106	21.5747	0.2359
8min	21.6396	21.3983	0.2413
10min	21.8166	21.6050	0.2116

The Screening and Dosage of Rust Removing Additives

The Screening and Dosage of Corrosion Inhibitor. The dosage of corrosion inhibitor is the key of the corrosion inhibition security. If we use lower dosage, the steel products cannot get a effective protection. If overusing, it is not economical and reasonable. In the experiment, we add urotropine and sodium benzoate separately with the same dosage into 20ml acid liquor, and the selected steel samples are immersed in the two kinds of solutions, then we measure the weight and their corrosion inhibition rates to compare the results of the two corrosion inhibitors, which shows that urotropine is better and its optimal concentration is up to 0.2%.

The Screening and Dosage of Complex Agent. Adding EDTA and triethanolamine separately into the solution for rust removing, after 8 minutes we can find the result of EDTA is better and the optimal dosage turns to 3%. (see table 3)

Table 3 the optimal usage and composition of complex agent

complex agent (dosage)	EDTA 1%	EDTA 2%	EDTA 3%	EDTA 4%	triethanolamine 1%	triethanolamine 2%	triethanolamine 3%	triethanolamine 4%
weight before rust removing (g)	21.4636	21.4387	21.8930	21.3726	21.3672	21.7901	21.5721	21.4875
weight after rust removing(g)	21.2974	21.2470	21.6850	21.2212	21.2325	21.6319	21.3741	21.2996
weight of removed rust (g)	0.1662	0.1917	0.2080	0.1514	0.1347	0.1582	0.1980	0.1879

The Dosage of Surfactant and 0leic Acid. Through the testing of lauryl sodium sulfate and oleic acid, we can get the results that the optimal dosage for lauryl sodium sulfate is 0.3% and the best for oleic acid is 0.1% which is just cover the liquor surface.

Conclusion

The rust remover formula mainly contains acid, corrosion inhibitor, complex agent and surfactant in the experiment. The best acid concentration is 30% and the optimal dosage for additives as follows: 0.2% urotropine, 3% EDTA, 0.3% lauryl sodium sulfate and 0.1% oleic acid. The adding of a certain amount of complex agent during the experiment generates the bivalent and trivalent ferrous ions, which lead to the reduction of free ferrous ions and slower the declining speed of acid concentration, and then ensure the adequate reaction between iron oxides and acid. The function of surfactant is to decrease surface tension between steel and cleaning liquor, which can make the generated bubble leak

out of it easier and less hydrogen embrittlement. The adding oleic acid in the solution surface forms an organic molecular layer, which is effective to prevent the acid mist form escaping, reducing the consumption of acid and environment pollution. Therefore, this rust remover can remove the corrosion quickly and efficiently, non-burning and non-burst, non-volatile, little corrosion for steel substrate, low price, easy to get the materials and convenient for using, simple to make but widely used, with a high economic returns and social benefits, high value in industrial application, obviously inhibit acid mist and prolong the life of acid liquor.

References

[1] China Petrochemical Equipment Management Association. The Corrosion Resistance Metal Materials and Corrosion Prevention Technique [M]. Corrosion and Protection Manual, Chemical Industry Press, 1990:945-991

[2] Jiang Liqiang, Zheng Jingwu, Li Hua. Study on Acid Fog Inhibitor and Corrosion Inhibition for Pickling Process of Hydrochloric Acid [J], Corrosion Science and Prevention Technology. 2004，16(2):98-101

[3] Gao Junlin, Zhao Guozhi. Study and Application of Environmental and Efficient KM Metal Cleaner[J], Corrosion and Protection,2008，29(6):15-17

[4] Zhou Yong. Study on Corrosion Inhibit and Derust Action of Additives in Mixed-acid Derustor[J], Chemical Engineer.2000，8(4):6

[5] Ma Ying, Zhang Jiwei, Zhang Lei. Research and Development of Normal Temerature Water-Based Metal Cleaner, Automobile Technology & Material[J],2004(9):122-126

[6] Li zhancai. Study on the chemical rust removing of corrosion inhibitor used in the raw water transportation pipeline of Waterworks[J]. Corrosion & Protection in Chemical Industry,1997(2):57-60

[7] Wen Songnian, Nie Changming, He Xiaomei. New 4-in-1 Removing Agent for Oil and Rust[J]. Chemical Industry Times,2009,23(1):23-31

High Performance Structures and Materials Engineering
10.4028/www.scientific.net/AMR.217-218

Study on a New Formula for Rust Remover
10.4028/www.scientific.net/AMR.217-218.774