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DETECTION OF CORROSION RESISTANCE OF COMPONENTS IN CYCLIC SALT SPRAY

Štefan Álló[1], Vladimír Kročko[1], Tamás Ibriksz[2], Jan Mareček[3]

[1] Department of Quality and Engineering Technologies, Faculty of Engineering, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic
[2] Department of Materials Science and Technology, Faculty of Engineering Sciences, Széchenyi István University, Egyetem square 1, 9026 Győr, Hungary
[3] Department of Agricultural, Food and Environmental Engineering, Faculty of Agronomy, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

Abstract

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The aim of this research is, to investigate the influence of two types of cyclic salt spray tests on parts surface treated with galvanizing.
On the selected components was performed the method Zn-Ni surface treating on the bath line. Subsequently were the components embedded in the corrosion chamber, where was performed two types of cyclic salt test. In the first test was performed 4 hour salt spray, 8 hours drying, 60 hours condensation and 24 hours drying. Once cycle lasted 96 hours, and it was repeated 4 times. During the second test was performed 2 hours salt spray, 2 hours condensation. The cycle was repeated 4 times, that means 96 hours. After the cycle was performed 72 hours free relaxation in the corrosion chamber, on 20–25 °C temperature.
As the research showed, after the cyclic salt spray was no red corrosion on the selected components. The white corrosion appeared only slightly.

Keywords: salt spray, corrosion, surface treatment

INTRODUCTION

Material and energy- saving more environmental friendly technologies have an increasingly important role in industrial practice. Machining, work load and special requirements have to be related to the product mass at the lowest acceptable volume (Bagyinszki, 2009).

The aim of surface treatment is to reach the desired properties (Bujna, 2008; Čičo, 2013) and to protect the surfaces of components from long-term side effects. The aim of salt spray test is to check the resistance of surfaces against corrosion (Vetter, 2005).

MATERIALS AND METHODS

Zn-Ni Surface Treatment on Suspension Galvanizing Bath Line

The most important processes during the suspension galvanizing are degreasing and rinsing. They are preformed before the application of coating. The galvanizing process takes place twice a weak in acid bath and is followed by repeated rinsing.

In our research, we used 6 same components, which are used in vehicles. On the components was performed the suspension galvanizing process. The thickness measurement was carried out with an X-Ray machine, type Fischerscope X-Ray DLB.

During the measurement the value of the thickness was lying in the volume of 9–11 microns. The requirement of the thickness value is between 8 and 13 microns.

Corrosion Tests in Artificial Atmospheres – Salt Spray Test

Salt spray tests are mainly used to determine the integrity of breach such as porosity and other defects of metallic coatings, organic coatings, coatings formed by anodic oxidation and conversion coatings [ISO 10289, ISO 9227].

1: *The controlled component*

Cyclic Salt Spray Test

The most commonly used salt spray test is the long-term investigation. Generally the long-term investigation consists of several hundred hours continuous testing. In this research we applied two types of cyclic salt spray method. The first cyclic salt spray test consists of 4 hour salt spray, 8 hour drying, 60 hour condensation and 24 hour drying. The duration of one cycle was 96 hours, and the whole test consist 3 cycles, i.e. 288 hours. The second cyclic salt spray test consist of 2 hour salt spray and 22 hour condensation. The duration of this test was 4 cycle, i.e. 96 hours, and after the cyclic test the components were leaving resting on room temperature. In both cases we used different components.

During the test, we put the tested components in the salt spray corrosion chamber (manufacturer: Ascott tip cc 1000 ip)

Tab. I and Tab. II describes the processes of the two cyclic salt spray tests.

I: *First salt spray test*

1	4 hr Salt spray	5% salt solution	35 °C chamber temp.
2	8 hr Drying		40 °C chamber temp.
3	60 hr condensation	100% humidity	35 °C chamber temp.
4	24 hr drying		40 °C chamber temp.
Total: 3 cycles = 288 hours			

II: *Second salt spray test*

1	2 hr Salt spray	5% salt solution	35 °C chamber temp.
2	22 hr condensation	100% humidity	40 °C chamber temp.
Total: 4 cycles = 96 hours			
3	96 hr resting		25 °C Room temper

RESULTS

The corrosion test and salt spray test are described in the standard ISO 9227: 2007, and the methods of corrosion testing of metallic and other inorganic coatings on metallic substrates is specified in ISO 10289:2003.

The standard ISO 10289 specifies the appearance of white and red corrosion.

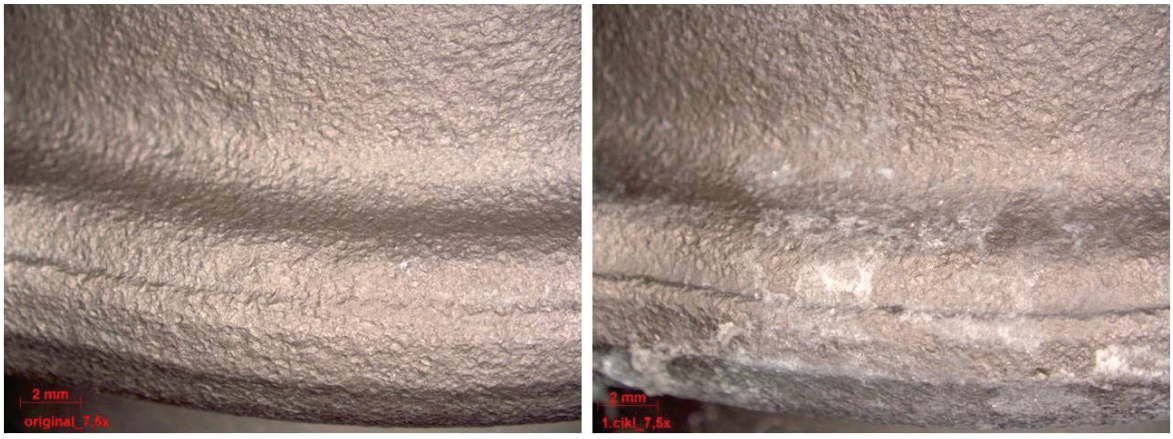
On the Fig. 2 are two samples. The upper sample is the original, the lower sample is the used one, after the first cyclic test.

On the Fig. 3 are two samples. The left sample is the original, the right sample is the used one, after the second cyclic test.

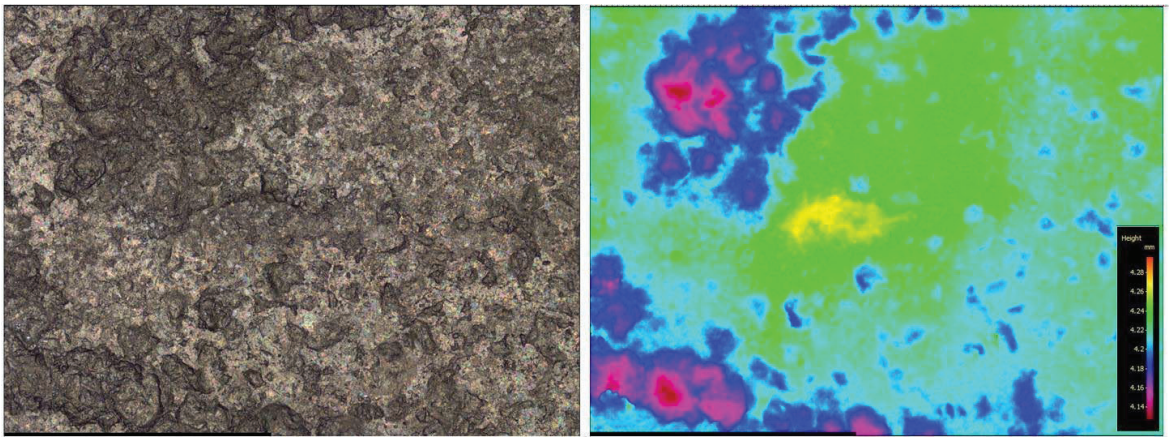
As the optical result shows, on the surface of the components is just slight white corrosion, which did not impair the surface Zn-Ni. According

2: *The optical result of the first cyclic salt spray test*

3: *The optical result of the first cyclic salt spray test*



4: *Optical Zoom of two surfaces*



5: *Surface comparing*

to the ISO 10289 standard, after the performed two cyclic salt spray test the evaluation of the level of protection is higher than nr. 9, and the evaluation of changes of appearance is very low.

Microscope Measurement

During the test we performed a microscopic test with an stereo microscope and focus microscope (manufacturer: Zeiss, tip Stereo Discovery V20 and Alicona, tip Infinite Focus).

On the Fig. 4 are two surfaces. The left surface was measured on the original component, the right surface vas optical zoomed after the first cyclic salt spray test. As the microscope measurement shows, during the cyclic salt spray test on the controlled surface came only the white corrosion out.

Fig. 5 was made with the Infinite Focus microscope. The figure consists of matching 4 scanned pictures. The left side shows the investigated surface, with slight white corrosion, but without a sign of red corrosion, which can damage the raw material. The right side shows the height difference on the scanned surface, which is shown in color difference. The yellow color on the figure indicate the highest point on the surface, the pink color indicate the lowest point. It should be noted, in this case the pink color does not mean material damage.

CONCLUSION

In this research, we investigated the influence of the cyclic salt spray tests on the corrosion resistance. Corrosion is one of the defects due to which we must replace the components on cars. The galvanizing surface treatment has been made to fulfill the customers requirement. After this process was on the components performed two different cyclic salt spray tests, with a duration of 288 and 96 hours. After the microscopic investigation, we can conclude, the Zn-Ni surface treatment satisfy not just the customer's requirements, but also the resistance of the surface against corrosion.

Acknowledgement

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Contact information

Štefan Álló: stefan.allo13@gmail.com
Vladimír Kročko: vladimir.krocko@uniag.sk
Tamás Ibriksz: ibriksz@sze.hu
Jan Mareček: jan.marecek@mendelu.cz