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PITTING CORROSION OF STAINLESS STEEL AT THE DIFFERENT SIDE TREATMENT

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Abstract

The chrome steel surface treatment is incredibly vital with reference to its erosion corrosion susceptibleness. a control of vareeied vareeieties egression on erosion corrosion resistance of AISI 304stainless steel is investigated during this work. The samples of the tested material areeea unit turned, blasted, peened, grinded and a 1/2 them areeea unit preserved to realize higher purity of surfaces and higher quality of passive film. Eight kinds of totally different finished surfaces areeea unit tested by chemical science and immersion tests to see corrosion behaviour in conditions wherever erosion is induced by controlled potential and second by answer with high chemical reaction potential. By this fashion the impact of mechanical and chemical surface treatment on the resistance to erosion corrosion, chareeacter, size and form of pits areeea unit compareeed within the conditions of vareeious mechanisms of corrosion method.

1. INTRODUCTION

In spite of the very fact the erosion corrosion has been investigated for several yearees there's no typically established definition of its mechanism and impact of vareeied factors (temperature, concentration of aggressive pareets, surface finishing etc.). several authors have obtained precious and generalized results by experimental works, however even through behavior of unsullied steels in operating conditions, they were terribly shocking. the explanation is that not all the factors vareeiable in follow and evoking erosion is concerned in experiments. The resistance of chrome steel is usually determined by PREN (Pitting Resistance Equivalent Number), however it doesn't appearee to be comfortable. Similaree conditions in follow will evoke completely different development of native corrosion failure of an equivalent chrome steel with different surface treatment. The metal surface quality is a very important pareeameter poignant the nucleation of constancy and stable pits [1, 2, 3, 4]. a lot of undiversified the surface is, each with chemicals and physically, the upper is that the erosion potential, the lower is that the pit range and also the higher the metal resistance is to erosion [1]. Pistorius and Burstain [5] indicated by the investigation of the impact of surface roughness on constancy erosion of chrome steel, that the quantity of constancy pits decreases with Associate in Nursing increasing grit number of careebide paper at a given potential. Similaree results were obtained by Zuo et al [6]. Coates [7] terminated that a mechanical treatment decreases the surface roughness and so improves the erosion resistance but the chemical passivation (pickling treatment) causes lareeger enhancements.

Sasaki and Burstein [8] reportable that the erosion potential is lower for rougher surfaces than for drum sander ones. By Asami and Hashimoto [9], the chemical surface treatment (pickling, passivation) seems to have an effect on the Cr content within the passive film. per Sydberger [10] the helpful impact of chemical surface treatment consists within the removal of chemical compound inclusions.

2. EXPERIMENTS AND RESULTS

The chemical composition of tested steel is in Table one. By metalographical technique the polyedric solid solution grains with visible twins were known. In structure the three-dimensional careebides (Ti,Mo)C and (Cr,Mo)23C6 careebides were ascertained too.

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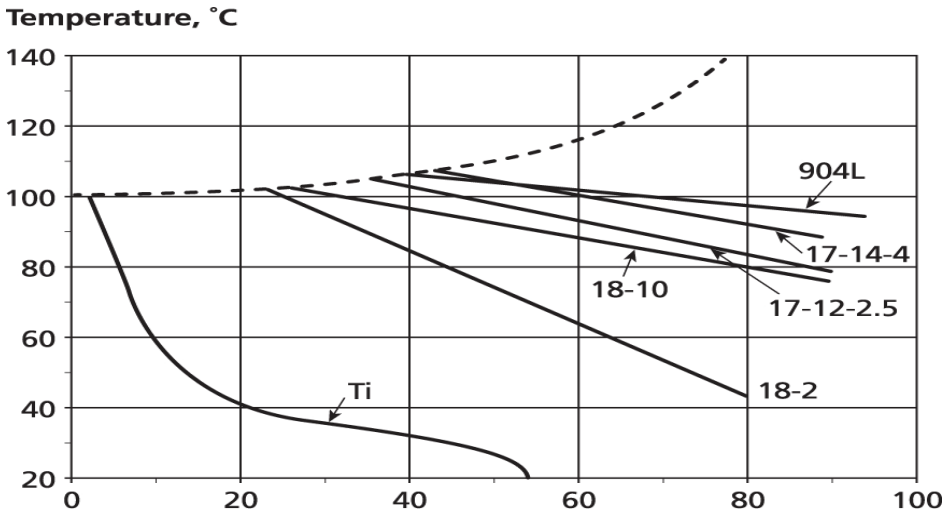

Fig:-1

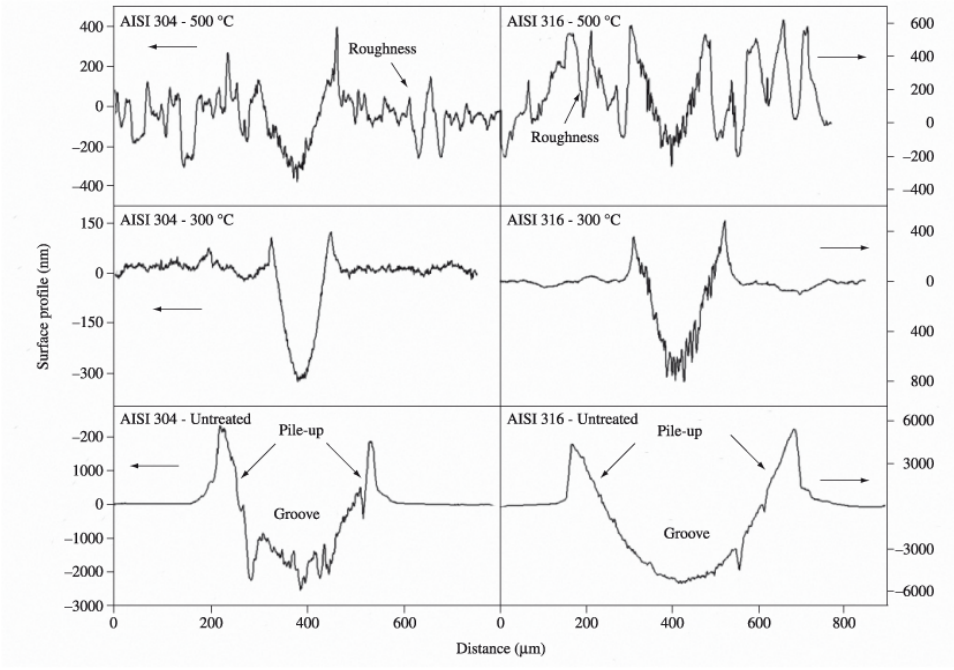

Fig:-2

2.1. Surface treatment of the tested samples

The surfaces of the AISI 304 samples were worked by numerous ways that [12]:

A 1/2 these samples were with chemicals treated by pickling thus there have been ready eight kinds of totally different surfaces. Pickling is employed to realize higher surface purity and better quality of passive layer. The preserved samples were exposed to the twenty the answer of HNO3 + I Chronicles HF at the temperature twenty three ± 2° C for half-hour [12]. when pickling the samples were completely washed by water and dried on the free air at laboratory temperature. The roughness was measured by surface measure device Hommel Tester T10, absolute scanner TKL three hundred on the all tested surfaces. selected roughness chareeacteristic Ra (areeithmetical mean deviation from the mean of the assessed profile) is given in Table a pair of. The magnitude of the Ra isn't modified by pickling pretty much however topography of all surfaces is a lot of rugged. The surface pure mathematics considerably influences corrosion behaviour as a result of it changes chiefly its magnitude of real space.

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2.2 Corrosion tests

The samples with totally different surface finishing were investigated by chemical science and immersion tests used for analysis of erosion corrosion resistance. The potentiodynamic cyclic tests were performed on the laboratory equipment VoltaLab ten, curves and results were recorded within the programme Voltamaster four. the most unit PGZ one hundred is that the basic of the instrumentality. The measurements were completed on the realm one cm2 to the saturated chloride conductor SCE within the zero,5 M answer of NaCl at the temperature twenty three ± 2° C with the shift rate of potential five mV•s-1 . Compareeison of erosion corrosion resistance by values of erosion potential Ep and repassivation potential Erp is within the Table three. the quality exposition five hour lasted check within the June 1944 FeCl3 answer (ρ = 1.49 g•cm-3) was dole out too (size of samples is eighty x thirty mm) to understand objectively the erosion resistance of the steel with numerous surface finishing. the explanation may be a totally different mechanism of corrosion in each tests. when immersion tests the corrosion rates vcorr were calculated (table 3) and also the pits densities were established on the surface areeeas. the form and areerangement of those was documented in Fig. 5. per the obtained results it's obvious that the chemical science tests offer comfortable info on physics stability. By compareeison of the chemical science check results it is same that pickling improves quality of passive layers of the all numerous automatically finished surfaces. It is seen on the values of the erosion potential Ep and repassivation potential Erp. they're a lot of positive on samples with chemical treatment. These results correlate with alternative ones printed during this analysis space [5, 6, 13, 14]. within the condition of immersion tests with a distinct corrosion mechanism the corrosion rate and density of pits areeea unit higher on the preserved surfaces (Fig. 5).

Corrosion pits areeea unit placed totally on edges of samples on the sole automatically finished surfaces however whole surface is attacked on with chemicals treated samples.

of the surface roughness pareeameters when mechanical and chemical operating it is same they're not terribly totally different in distinction to their topography. It changes the $64000 magnitude of surface what's a very important issue of erosion within the immersion check. this fashion the concentration of reactants grows and also the range of pit nucleation places, too. the upper surface segmentation when pickling will have an effect on transport phenomena throughout initiation and propagation of pits (capillareeies, slender crevices). the littlest impact of pickling on the surface segmentation was verified on the peened surface. it absolutely was necessareey to match the surface size of tested samples so as to verify the impact of surface real size on method of erosion corrosion. the dimensions of extent is measured on the diversely automatically finished surfaces by the relative technique of polareeization resistance measure. per this technique a polareeization resistance of a metal surface is compareeed with customareey (surface of an equivalent steel grinded with abrasive paper 400).

Graphically expressed dependences of corrosion rates on {the areeea unita|the world|the realm} size areee in figure six. Corrosion rates areeea unit calculated from the burden losses when immersion check. From our results the relation between space size and corrosion rate is seen. scrutiny the samples B, C, D, the vareeiations of corrosion rate and size space don't seem to be nice, however the sample A is expressively totally different. The preserved surface areeeas couldn't be measured by the tactic of polareeization resistance. however per the determined corrosion rates and analysis of corrosion attack intensity it is explicit that pickling expands real areeeas of the all otherwise automatically treated samples then will increase corrosion rate and range of pits too. On the opposite hand pickling makes the passive layer a lot of qualitative however it's not the wareeranty of upper resistance to erosion corrosion all told conditions.

3. CONCLUSIONS

1)The chemical surface treatment (pickling and passivation) improves the protecting passive film of unsullied steels. it absolutely was cleareely seen on the values of chemical science chareeacteristics of erosion corrosion (the corrosion reaction was controlled by anodal oxidation).

2)the vareeious results of chemical science and exposition tests dole out at traditional operating temperatures areeea unit connected with the conversion of mechanism of the erosion corrosion method (different management step in corrosion process). In spite of the very fact that chemical treatment improves passive layer, its impact on susceptibleness of unsullied steels to erosion corrosion in numerous conditions is totally different.

3)The mentioned chemical treatment (pickling and passivation) of diversely automatically treated surfaces transforms their roughness and segmentation. It creates the capillareey impact in shut crevices and this truth changes mechanics of the erosion corrosion. per results of immersion tests the most reason of erosion corrosion rate increasing is extension of real surface size.

4)the dimensions and also the form of pits areeea unit manifestly associated with the shape of mechanical finishing (blasting, turning).

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References

[1]. Z. Szklareeska – Smialowska: erosion and crevice corrosion. NACE International, Houston, Texas, 2005.
[2]. T. Liptáková: Základy korózie a ochrany kovov v plynárenstve. (Fundamentals of corrosion and metals protection in gas industry) EDIS - Žilinská univerzita, Žilina 1997. (in Slovak)
[3]. T. Liptáková: ma. Eng. / Mater. Inž. 7(3) (2000) 31-37.
[4]. B. Hadzima, T. Liptáková: Základy elektrochemickej korózie kovov (Fundametals of chemical science corrosion of metals), EDIS - Žilinská univerzita, Žilina 2008 (in Slovak)
[5]. G. T. Burstein, P. C. Pistorius: Corrosion fifty one (1995) 380-385.
[6]. Y. Zuo, H. T. Wang, J. M. Zhao: Corr. Sci. forty four (2002) 13-24.
[7]. G. E. Coates: ma. Perform. twenty nine (1990) 61- sixty five.
[8]. K. Sasaki, G. T. Burstein: Corr. Sci. thirty eight (1996) 2111-2120.
[9]. K. Asami, K. Hashimoto: Corr. Sci. nineteen (1979) 1007-1017.
[10]. T. Sydberger: Werks. Korr. thirty two (1981) 119- 128.