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EXPERIMENTAL ANALYSYS OF RAIL CLIP

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ABSTRACT
In this article, the results of experimental analysis of rail clip will be shown. The main function of this element is providing relationship against turning rails and it is used for attachment with crane trail and rail A65 in electrolysis of the aluminium processing plant in Podgorica. The results will be explained by the factors whose influences are important.
Keywords: experimental analysis, rail, clip, crane, trail, aluminium processing plant

1. INTRODUCTION

In an organized process of production there is continious displacement of materials, during the working operations (at industry, civil engineering, etc.). For the purpose are used transport maschines which are irreplaceable in transporting different kinds of carries. The cranes as transport maschines for its rute use crane girders and crane rail. The shrinks, which transfer lateral load from crane rail to crain girder, are used for its conjunction. Nevertheless, modeling such structures as clips, lots of sources of their loads must be taken to consider as any other structure. The main function of those clips is to secure the connection against turning over the rails and taking over lateral forces to which are exposed. The extent of lateral forces depends upon several factors, as nominal portability of crane, the main velocity of lifting, nominal velocity of lifting, the volume of the crane.etc. [1]

The shrink, which is the subject of experimental analysis is used at the process of electrolysis aluminium processing plant at KAP and for connection between the crane rail A65 and crain girder. The crane is working during the three shifts, for 24 hours - during this time it has to make next operations, two times: exchange of anodes at the cells, filling of the bunker with Al_2O_3 from the sillos, dozing of Al_2O_3, penetration of the shell at the cells, extraction of the metal from the cells using the pan with the absorbing pipe and purification and ragging out the parts of the cells. The oscillations are occuring during the penetration of the shell at the cells, which are specially expressed at the main beams. During this technological operation the levels of the load and stress in the construction arent critical but because of its dynamic caracter they compose the appeareance of overwork of the material of the construction. The crane is loaded, with the maximal static load, under the conditions of normal exploatation, during the process of exchange of anodes and loading the pan with the liquid metal [2]. The crane EC is acccording to standard ranked into group of very hard exploatation conditions, into class 4. Therefore, it is clear that the clips are exposed to the dynamic loads, but in the experimental analyses the nature of the load is statical.

2. THE EXPERIMENTAL POSTULATE

The experimental analyse of rail clip is observed at the Faculty of Mechanical Engineering at Niš. The examination is exerted on the press of 100 KN, while the quantity of the load was controled by force emitter HBM U2A of 100 KN. The experimental analyse is done for two rail clips and the load was inflicted in many etapes. The clip was made of steel Č 0561(ST 52 – 3) [3] with the yield stress σ_T = 345 N/mm^2 and E = 206000 N/mm^2. During the clip rails test it happened physical accidence of the gage number 2 at the rail clip number 2 so the results for the gage aren't shown.

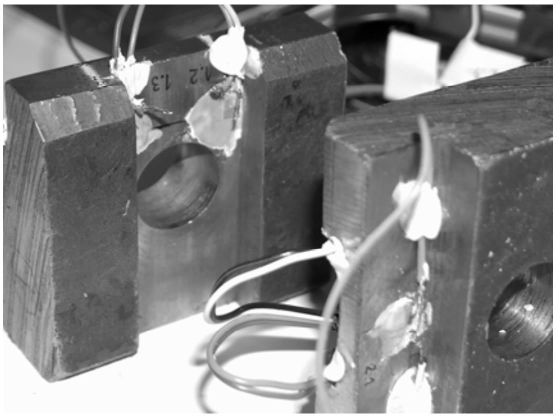

Figure 1. The gages at the rotund and zone of the reliance

Figure 2. The rail clip at the place with the compress and the shrink

The gages at the shrinks are pasted at the zones of the concentration of the stress. The gage no.1 because of its physical quantity wasn't possible to paste at the rotund of radius 4mm, but is put at the bottom of the rotund. The gages no.2 and no.3 are pasted at the zone of the reliance, around the gap of, what is shown at the figure 1.

3. EXPERIMENTAL ANALYSIS

3.1. The results of the experimental analyse

During the process of experimental analyse the load was inflicted in several etapes-by the etape is implied series of the loads and decompression of the rail clip. For the rail clip number 1, the experimental analyse is executed in four etapes and for the rail clip number 2 in three etapes. In the follow up will be shown the probe charts which are specific upon its contours which are basics for this paper.

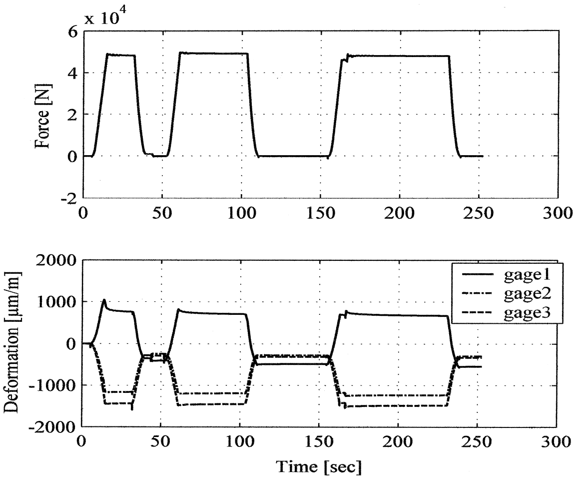

Figure 3. The second phase of rail clip1 probation

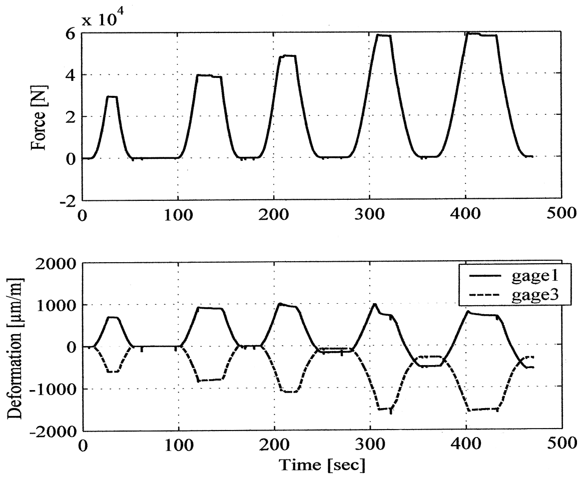

Figure 4. The second phase of rail clip2 probation

The rail clip is under normal exploatation conditions loaded with the static force of 11 KN.The results of stress will be shown in interval of 2 KN to 10 KN with load step of near of 2 KN. For the load of 11 KN deformations for gages were at the elastic zone. Those diagrams show the rezults of turned diagrams of deformation for individual gages.

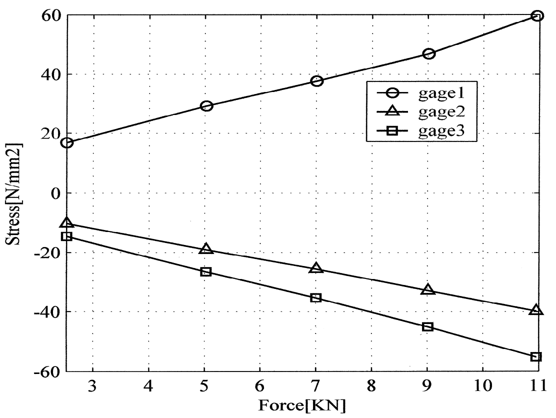

Figure 5. Diagrams of stress for the rail clip1

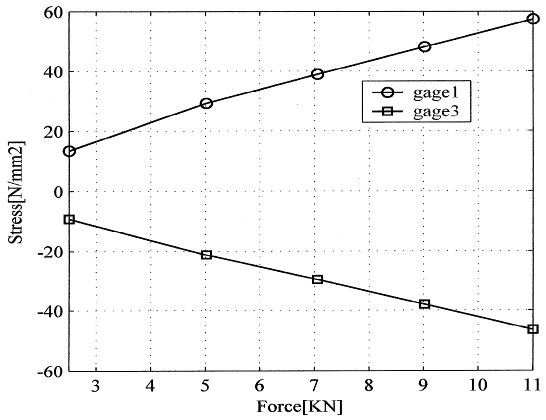

Figure 6. Diagrams of stress for the rail clip2

Table 1. Experimental results of stress for gages

	Stress [N/mm^2], clip 1				Stress [N/mm^2], clip 2	
Force [N]	Gage 1	Gage 2	Gage 3	Force [N]	Gage 1	Gage 3
2518.508	16.7764	-10.2439	-14.6126	2504.003	13.4836	-9.3664
5025.167	29.3117	-19.0791	-26.5873	5015.973	29.2551	-21.2055
7000.667	37.7345	-25.6081	-35.3722	7055.009	38.9635	-29.6669
9013.144	46.8141	-32.9296	-45.0445	9018.864	48.0871	-37.9823
10953.51	59.5773	-39.7719	-55.2629	11004.58	57.4451	-46.4918

3.2. The deformation velocity

Nature and geometry of the load makes the stress shape in the railway clip triaxed - steric. For explanation of such complex state may serve the test of dilatation, which gives so much informations about the factors or, its better to say conditions which influence at goings - on of the materials, and at the quantity of attained deformations. The deformation velocity [4] (the velocity that the test-tube is loaded and dilatated) has the similiar influence at the curve (σ, ε) as the temperature influence also. Decrement of the velocity of the deformation has the same influence as the increment of the temperature, so that under small velocities of deformation (slow deformations) the toughness of materials increases and under the fast ones it decreases. Considered in the case of the experiment this would mean that under inflicting the load the toughness of material decrease but under the constant load (the load doesn`t change as time passes by) the toughness of the material increases. It is certainly sure that the different velocities of the load influence on attaining the different results of deformations. The velocity of inflicting the load is caracteristic of the compress and it amount is 5 KN/sec.

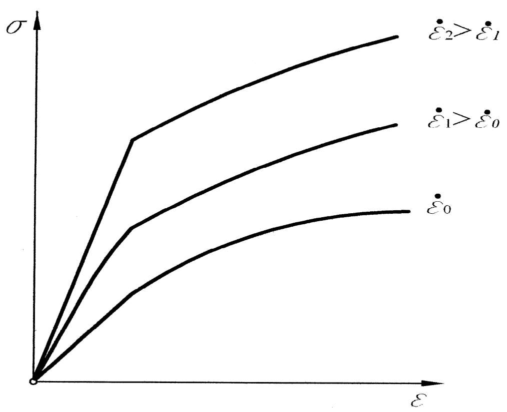

Figure 7. Influence of the velocity of the deformationonon on the toughness of the material

3.3. The plastic hardening and elastic hystresis

The effect of the plastic hysteresis may be explained by using the diagram (σ, ε) for axial tension of the test - tube [4]. It is notable, on the figure 8. that at the optimal moment overall deformation ε, composed of two components - elastic and plastic deformation. If we disburden the point *a* then the stress and the deformation would decrease according to elastic law, to the point a_0, where we have

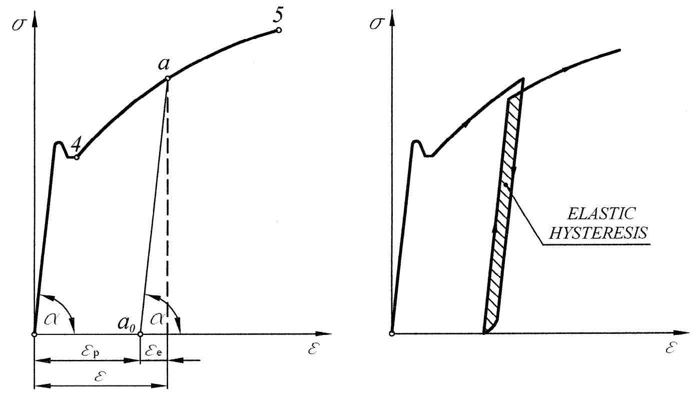

Figure 8. Elastic histresis

force and stress equal to zero, and remanent plastic deformation ε_p. Further more, if we load the test - tube again we would turn to the point a according to the line a_0 - a, and went on according to curve a – 5. Considered in the case of the experiment, the plastic deformation will appear periodically.This means that the plastic deformation will, in the beggining, after the achieving the deformation of the flow, will appear in the next stage in the case of load which is higher than the previous one which generated plastic deformation. This is the way how the plastic hardening of the material of the railway clip is exerted, considering the increasement of the load from phase to phase of the examination test. Under the periodical infliction of the load, as in the case of the experimental analyze of the railway clip, the elastic hysteresis, which represents work in the period of the load and disburden that is spent on the heat, appears also [4].

4. CONCLUSION

Under the specified facts which influence on the results of experimental analyses, there are certainly more other facts that we didn’t mention. In those we may number: gear gaps that inflow at the overlap of the railway clip, stiffness of the elements of the gear, friction and glide at the conecting surfaces of the gear and railway clip, penetration of the compress at the railway clip which increases under the increasement of the load, etc. It can also come to phenomenon of crawling under the high velocities of deformations and relaxation of stresses [4], it can come to phenomenon of viscosity of materials. All itemiyed facts influence at the results of experimental analyzis. It is sure that the number of questioned railway clips isn't enough for getting the clear picture of deformations dimension, so that number has to be enhanced. It would be got much more sorted rezults of experiment as more precise picture about the facts that influence at experimental results.

5. REFERENCES

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