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DETERMINATION OF FRACTURE TUGHNESS WELDED CIRCUIT

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ABSTRACT
Influence of the heterogeneity of the structure and mechanical characteristics zavarenog circuit can be seen in the peak position of fatigue cracks.Fracture toughness with direct deformation is made in order to determine the critical factors of intensity voltage. This testing will work with three groups of test tube depending on the place where the cut is made:

- *the first group, test tube with a cut in the basic metal,*
- *the second group, test tube with a cut in the metal who is welded,*
- *the third group, test tube with a cut in the zone of influence of heat.*

According to standard ASTM E399 we need to perform the preparation of test tube to create conditions of flat deformation.
Keywords: toughness, breakage, structure, weld, test tube.

1. INTRODUCTION

Determination of fracture toughness in the direction deformation test specimens from test tube butt welded compounds from devastated area is made according to standards ASTM E339,ASTM E813,ASTM E1152,ASTM E1820 and BS 7748. For testing were used test tube bending in three points, whose geometry is defined wuth standard ASTM E399
This testing will work with three groups of test tube depending on the place where the cut is made:

- the first group, test tube with a cut in the basic metal (BM),
- the second group, test tube with a cut in the metal which is welded (WM),
- the third group, test tube with a cut in the zone of influence of hea(ZIH)

2.Preparation of examination
Process of preparing test tube, as well as testing, processing of examination results, and interpretation of results was made according to ASTM E399.

On the basis of data collected with kidalice and COD sender, were constructed diagrams force F-opening of top cracks δ.
The appearance of diagrams, for test tube with a cut in the basic metal (BM), for a test tube with a cut in the metal which is welded (WM) for a test tube with a cut in the zone of influence of heat(ZIH) is given in Figure 1.

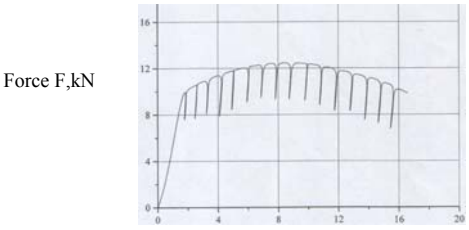

Figure 1. Diagram F-δ test tube with a cut in WM

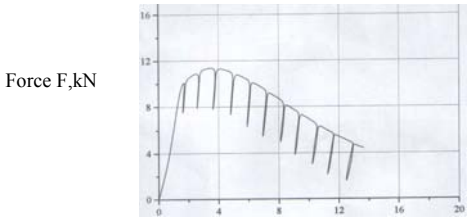

Figure 2. Diagram F-δ test tube with a cut in BM

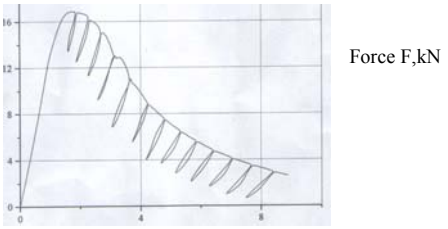

Figure 3. Diagram F-δ test tube with a cut in ZIH

Table1.The results of measuring the length of crack in test tube with a cut in BM,WM,ZIH

The place where the cut is made	Symbol of test tube	The length of cracks,a,mm					Arithmetic mean, A_{sr},mm
		A_1	A_2	A_3	A_4	A_5	
BM	**BM-S-1**	4.36	5.21	6.12	5.30	4.41	**5.08**
	BM-S-2	4.18	5.02	6.01	5.11	4.19	**4.90**
	BM-S-3	4.24	5.11	6.06	5.09	4.29	**4.96**
WM	**WM-S-1**	4.46	5.38	6.26	5.41	4.52	**5.21**
	WM-S-2	4.31	5.27	6.12	5.30	4.35	**5.07**
	WM-S-3	4.09	5.04	6.02	5.09	4.11	**4.87**
ZIH	**ZIH-S-1**	3.68	4.67	5.52	4.49	3.45	**4.36**
	ZIH-S-2	3.85	4.72	5.56	4.79	3.95	**4.57**
	ZIH-S-3	4.06	5.02	5.86	5.12	4.14	**4.84**

Upon completion of examination we mark the top crack that are result of bending test tube.
Then test tube are broken,so that it would be able to measure initial a_o and final a_f length of crack. Measuring the length of cracks were carried out with a special microscope with a reticle along 5 parallel lines.

3.THE RESULTS OF MEASUREMENT

Measured length of cracks on 5 measuring places, with the mean value given in Table 1 for test tube taken out of the old circuit with a cut in BM,WM,ZIH.
Based on the obtained data are constructed J-Δa curve where the regression line is constructed according to ASTM E813. Obtained from regression line provided a critical J integral,J_{Ic}.

A typical example of curve obtained with testing test tube with a cut is given:

- in the basic metal (BM) in Figure 4,
- in the metal which is welded (WM) in Figure 5,
- in the zone of influence of hea(ZIH) in Figure 6.

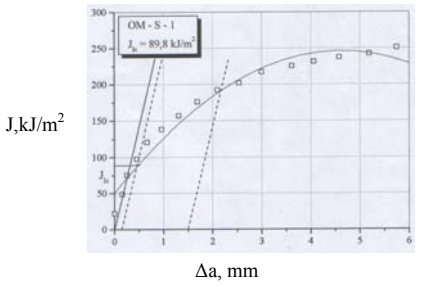

Figure 4. Diagram J-Δa of test tube BM

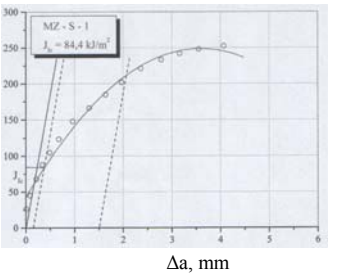

Figure 5. Diagram J-Δa of test tube WM

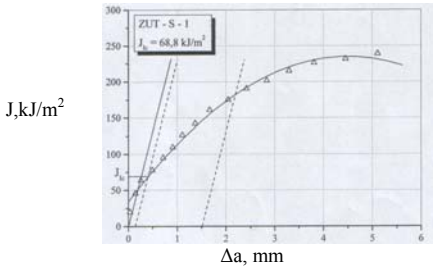

Figure 6. Diagram J-Δa of test tube ZIH

Knowing the value of critical J_{Ic} integral calculated values of critical factor intensity voltage or fracture toughness with direct deformation are made.
The calculated values of fracture toughness with direct deformation , K_{Ic},are given in Table 2 for test tube with a cut in BM,WM,ZIH

Table 2.Value parameters of breakage test tube of an old welded circuits

Symbol of test tube	**Critical J integral,J_{Ic},kJ/m^2**	**Critical factor intensity voltage, K_{Ic},Mpa m$^{1/2}$**
BM-S-1	89.8	144.0
BM-S-2	85.6	140.5
BM-S-3	87.2	141.9
Arithmetic mean	**87.5**	**142.1**
standard deviation	**2.120**	**1.7616**
WM-S-1	84.4	137.9
WM-S-2	80.7	134.8
WM-S-3	78.3	132.8
Arithmetic mean	**81.1**	**135.2**
standard deviation	**3.073**	**2.5697**
ZIH-S-1	68.8	123.3
ZIH-S-2	64.9	119.7
ZIH-S-3	70.3	124.6
Arithmetic mean	**68.0**	**122.5**
standard deviation	**2.787**	**2.5384**

4. CONCLUSION

Circuit components of welded structural and mechanical heterogeneity of welded circuit have a significant impact on its resistance to the development of cracks. Obtained are a little more value fracture toughness in direct deformation , $K_{Ic,}$ in all three groups of test tube. Maximum measured value have test tube with a cut in the basic metal, and the worst value has ZIH, which otherwise is represented as a critical place in the welded circuits. Notably differences 10% can be bring in connection with well-defined and implemented process welding. Obtained results of testing ($K_{Ic,}$ $J_{Ic,}a_c$) indicate two things. First, that the selected technology rEL welding process with warming up, gave the best results. Second, the obtained results of testing of materials and zavarenog circuit point to a pretty good situation and the basic materials and components zavarenog circuit. Second, the obtained results of testing of materials and welded circuit point to a pretty good situation and the basic material and components of welded circuit.

5.REFERNCES

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