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RESEARCH ON BIMETAL TYPE MOULDS WITH HIGH RELIABILITY

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Abstract: *Research has aimed to achieve through the welding load of hot stamping moulds for the type "of glass" pieces.*

Active surfaces of the mould for processing by hot pressing operation are found to intense abrasion type metal corrosion and metal combined with thermo-mechanical fatigue. This abrasion causes loss of material and circular-radial cracks of the working bodies which are made of tool steels low-alloyed with chromium, nickel, vanadium, molybdenum, etc., By improvement (hardening-recovery) they get a hardness of about 35 HRC and reception capability to shock but also a relatively low resistance to abrasion. Solution to increase the lifetime of the matrices developed by the authors is to strengthen highly stressed areas of bodies of work by charging appropriate welding materials developed.

Keywords: *bimetal type moulds, hot stamping, welding load, etc.*

1. RESEARCH OBJECTIVES

Research by exploratory method had the added objective of developing materials for filling the mould surfaces of the welding by TIG process, recommended in the literature [1] due to the possibility of tabling of anti-wear surfaces easily controlled geometry and physical characteristics relatively constant, and chemical technologies that achieve load and reconditioning by welding tool for making hot-pressed glass-type parts, fig.1, bimetal variant index as low cost and high reliability.

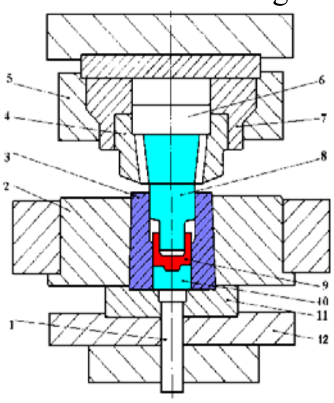

Fig. 1. An extrusion assembly tool on the hydraulic press 250 tf WPA (TPS)

1. Interior Extractor, 2. Container, 3. Extrusion die, 4. Clamping sleeve, 5. Support Ring, 6. Pressure Plate 7. Port pounches 8. Pounches extrusion, 9. Semi-finished extrusion 10. Lower Dorn, 11. Port-mould, 12. Motherboard.

Tribological analysis revealed ten mould damaged their removal from service by the degradation of punches by the abrasion wear at high temperatures approx. 450 ^{0} C, the lengths of approx. 50 mm forming cracks creep combined with a max depth 22mm max width and 4mm at the tip of the attack.

The analysis of the situation ,in fact, show up the following facts:

- Need reconditioning to increased performance and wear resistance in the active areas of stock meant to waste punches made of steels shown in Table 1 in the state enhanced

Tab. 1 Chemical compositions

Werkstoff no.	STAS 3611/88	Chemical composition,%									
		C	And	Mn	P	S	Cr	Mo	Us	V	With
1.2717	56NiCrMoV7	0,5-0,6	0,1-0,4	0,65-0,95	0,03	0,03	1,0-1,2	0,45-0,55	1,5-1,8	0,07-0,12	-
1.2344	40VmoCr52	0,37-0,43	0,90-1,20	0,30-0,50	0,03	0,03	4,8 -5,5	1,2-1,5	<0.35	0,90-1,10	0,30

- Manufacture of short punches from the tool steels in annealed condition by loading welding characteristics of reuse by reconditioning.

In order to obtain the desiderata mentioned above was intended: to develop and manufacture a batch of hollow rods 2.4 mm Φ VTCr20W4Ti and testing them according to technical limitation as presented in the literature [1].

- Theoretical and experimental determination of thermal treatment and heating temperature for the metal-metal torque applied, so as to obtain their good cooperation in the exploration, the demands with high degree of thermo-mechanical fatigue and triaxiality
- Highlighting the technological characteristics and their experimental verification in order to determine the optimal level of quality of welding loaded punches.
- Experience in manufacturing process parameters to optimize the fabrication technology

The results were analyzed and applied to the manufacture and reconditioning punch above presented.

2. MAKING HOLLOW RODS.

Develop the product recipe hollow rods VTCr20W4Ti mark, diameter 2.4 mm was made through exploratory research. We aimed to achieve this goal of high-performance products accurately copied the requirements of the documentation submitted by welding on metal assimilation (MD) [1] technology traditional manufacturing composite rods hollow core band by forming the production line in Figure 2. [2]

Fig. 2: Tubular rods production line

For this purpose were used for predicting the chemical composition of MD regression equations arc transfer the main alloying elements Cr, W [3]. The experimental set fill factor, defined by the mass ratio between the weight and the weight of the rod core, 0.55. To achieve a band of cladding was used Mn low alloy steel with a width of 10 mm and features high plasticity. The recipe was developed by optimizing the composite core mass participation in its constitution of ferroalloys, metal powders and sprouts and sprouting phase precipitation and technological parameters of manufacturing hollow rods were finally determined so as to obtain a core Tamping well anchored to the pipe.

The recipe of product was used to manufacture a lot of technology developed laboratory tubular rods with brand VTCr20W4Ti toroidal configuration with overlapping geometric wall over a width of about 1.2 mm and 2.4 mm in diameter. The lot was done to determine the characteristics of the product tested under the above mentioned prescriptions.
Chemical and physical features prescribed and experimentally determined weld metal deposited under standard conditions by TIG process are shown in the table below:

Tab. 2 Chemical composition of all weld metal

Values	Chemical composition% by mass										Hardness HRC
	C	Mn	And	S	P	Cr	Us	W	Ti	Other	
Prescriptions	Max. 1.0	Max. 1.5	Max. 1	Max. 0,02	Max. 0,02	Max. 18,0-21,0	Max. 1,0	3,5-4,5	Max. 0,5	Basis Fe	30-35
Determined	0,75	1,1	0,6	0,01	0,01	19,5	0,2	3,9	0,2	rest	33, 30, 31, 30, 32

Chemical composition was determined by spectral method with the program SPECTRUM-steel tools.

Analysis of data in the table shows the weld metal framing characteristics in technical prescriptions

3.TECHNOLOGICAL EXPERIMENTS.

Hardness values (Table 2) relatively low in comparison with the demands of high resistance to wear by abrasion intense hardening parameters to be determined after the application of surface machining by precipitation of active phases. Data in the literature [4] show for this type of material and precipitation of carbide phase Cr σ (sigma) in the temperature range 400-650 ° C, which requires conducting experiments to optimize the heat treatment of hardening of MD and including establishing its collaboration with the base metal during the application process heating and cooling maintenance of all base-metal weld metal. For this purpose there were taken from six punches in stock reconditioned, 6 plate specimens with dimensions of 100x20x10 mm which were loaded by welding a 10mm wide layer consists of five rows stacked one third of width. Welding parameters were established through exploratory research method. Preheat temperature between rows was determined on the basis of carbon equivalent sensitivity to cracking full namely deposit, account relationships prescribed by SR EN 1011/2004- Recommendations for welding of metallic materials. Welding parameters determined experimentally are presented in Table 3:

Table 3. Welding

Electrode diameter [mm]	Welding current [A]	Current	Gas safety	Gas Flow [L / min]	Temp. preheating and inter-row	Linear Energy [J / cm]
$2^{+0}_{-0.05}$	180 ± 10	CC^{+}	Argon	12 +1	300 ± 50	approx. 10

Process parameters in the table above were used for the four samples loaded by welding according to descriptions given, and these samples were used to optimize treatment hardening heat treatment to the diagram successive tests presented in Fig. 3.

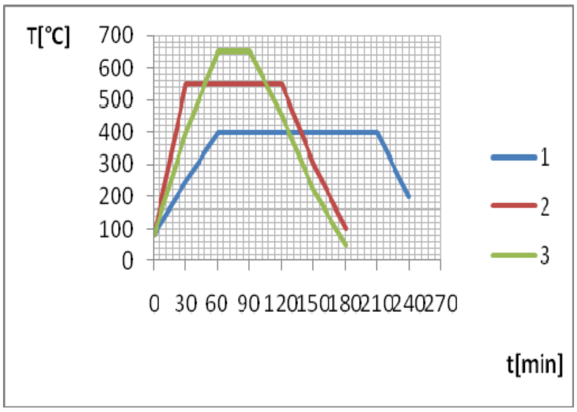

Fig. 3: Diagram of precipitation hardening heat treatment of secondary

1. Average 31.5 ± 1 HRC hardness, 2 - average 38.2 ± 5 HRC hardness, 3 - average 45 ± 1 HRC hardness

The options presented in the diagram on the basis of experimental results the optimum maximum hardness, determined on specimens tested to maintain a plateau at 650 ± 10 ^{0} C for a duration of at least 30 minutes.

4. RECONDITIONING OF PUNCHES

In order punches reconditioning existing stock it proceeded to the choice of 6 pieces of each type of material to remove surface defects in the area degraded by mechanical, metallic sheen to preheat and loading and welding, with parameters in Table 3. Anti-wear layers deposited in Figure 4 were designed so that after processing the final rates- Figure 5- there are no defects such as lack of material.

Fig. 4: Punch loaded by welding
Fig 5: Punch manufactured by the final odds

Punches thus obtained were heat treated according to the diagram in Figure 3, marker 3. Findings of the qualitative level of punches thus obtained was done by metallographic research and investigation of specific areas of assembly base metal / weld metal / heat-influenced area, carried out on samples taken from the punches. Metallographic structure and hardness variation diagram of the investigated areas is shown in Figures 6, 7.

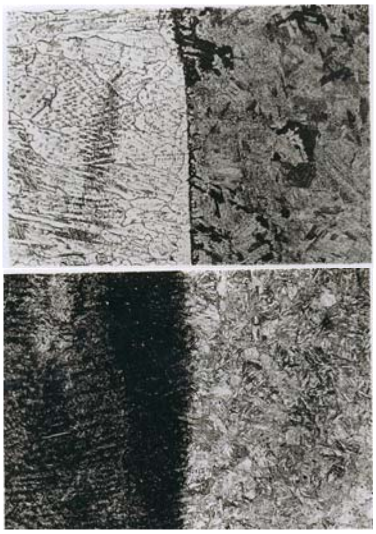

Figure 6: 100x metallographic structure

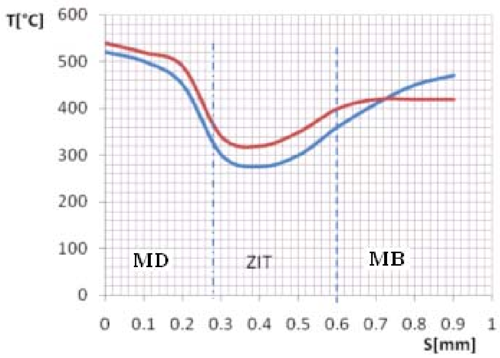

Figure 7: Diagram of hardness HV10 variation in specific areas

Data analysis of the figures presented above shows a good compatibility of anti-wear layers, which shows the structure of ferrous complex carbides rich in Cr, W and Ti, fine-grained, with the base metal that shows the structure recovery

Areas characteristic hardness variation is relatively low and insignificant in terms of reception and transmission capabilities of thermo-mechanical shock, occurring in the extrusion process, combined with high hardness of the deposit, which guarantees a smooth operation and good resistance to wear so taken punches.

5. CONCLUSIONS

There was developed a new technology for restoring and manufacturing the bimetal variant moulds by hot pressing process, the principles of sustainable development and increase the reliability requirements at lower costs.

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