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RESEARCHES REGARDING THE OBTAINING OF SPECIAL FILLER MATERIALS TUBULAR WIRE TYPE FOR WELD CLADDING

IOVANAS, R[adu]; TRIF, I[acob] N[icolae]; IOVANAS, D[aniela] M[aria]; FULGA, D[oru]; BINCHICIU, A[urelia] & IOVANAS, R[azvan] F[lorin]

Abstract: *The researches presented in this paper had as a goal the elaboration of new filler material tubular wire type for TIG, MIG/MAG welding used in reconditioning operations through cladding of tools used in plastic deformation processes. The novelty is that the filler materials tubular wire type are producing weld beads deposits with chemical composition and mechanical-metallurgical characteristics adaptable to the exploitation wear type, the alloying being made both in the wire and in the powder inside the wire, micro-alloyed with rare earths.*
Key words: *filler materials, tubular wires, cladding.*

1. INTRODUCTION

Usually, the plastic deformation tools are made of alloyed steels able to take over the complex loads wich are applied on them during exploitation, in order to produce bending, cutting, dieing, punching, squeezing. The active edges being extra loaded and subjected to complex wear are more rapidly deteriorating, diminishing the functional characteristics and the dimensional precision of the finish products. The basic idea is to manufacture tools for plastic deformation from tenacious, un-lloyed steels, able to take complex loads during exploitation.

Until now, the active edge cladding of the plastic deformation tools were made through electric manual welding with covered electrides (Iovanas, et al., 2008, Iovanas, et al., 2009), specially conceived and produced, alloyed with several alloying elements, that are producing a surface resistant to exploitation wear.

The researches made on route conducted to the producing of new filler materiald tubular wire tipe for TIG, MIG/MAG and plasma welding.

With the help of the new filler materials was possible the depositing of weld beads with chemical composition and mechanical-metallurgical characteristics adaptable to the exploitation wear, the alloying being made both through the wire and through the powder inside the wire micro-alloyed with rare earths.

2. MANUFACTURING OF FILLER MATERIALS FOR CLADDING

2.1. Consideration regarding tubular wires

The manufacturing of tubular wires for electric arc cladding is made sequential, based on complex technologies, that are offering to production process the properties to transfer basic materials from the product recipe to deposed material in standard conditions with prescribed properties.

The knowledge accumulated so far in the field of tubular wires manufacturing are underlining the fact that they are produced in two variants namely for welding with shield gas and with autoprotection (Binchiciu & Iovanas 1992, Iovanas & Iovanas 2006).

In both situations these are characterized through a powder core and a profile holster type, figure 1.

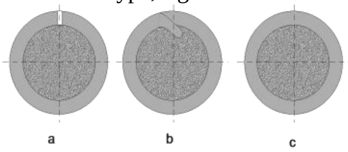

Fig. 1. Closing profile types for tubular electrodes
a) tube with simple closing profile butt type; b) tub cu profil de închidere simplu cu marginile suprapuse; c) tube with simple closing profile butt welded on the generatrix.

2.2 Manufacturing of special filler materials

In order to manufacture filler materials for cladding was analized the standard technology of tubular wires and rods manufacturing.

Thus was elaborated a special material for cladding type: tubular wire with composite core for weld cladding of hard layers, rich in chrome, tungsten and vanadium carbides, with high resistand to severe abrasion, metal on metal type, specific to machine loads in the field of cold or hot plastic deformation manufacturing.

The elaborated material presents the following characteristics:

- Deposed metal hardness min. 30 HRC in welded state and respectively minimum 40 HRC in aged through secondary precipitation state;
- The average chemical composition of the weld deposed metal is presented in table 1.
- Welding behaviour: specific to spray-arc process; the transfer of the molten metal take place in small and medium drops, melting is uniform.

Base materials used

For realisation of experimental researches were used the following base materials:

The chemical composition and mechanical characteristics of the cold rolled steel stripes are presented in table 2 and 3.

Fe %	Cr %	W %	Ti %	Other %
rest	17	4	0,3	max.3

Table 1. Average chemical composition of the deposed metal

Type	Chemical composition [%]					
A3K04M SF 558/96	C	Mn	Si	P	S	Al
15x0,4 mm	0,08	0,45	0,03	0,023	0,01	0,05
20x0,5 mm	0,05	0,29	0,02	0,015	0,019	0,04

Table 2. Chemical composition

Type	Mechanical characteristics		
A3K04M SF 558/96	Rm [N/mm²]	Rpo,2 [N/mm²]	A80 [%]
15x0,4 mm	329	237	37,2
20x0,5 mm	322	202,5	40,3

Table 3. Mechanical characteristics

Next were determined the chemical composition for the powder materials from the core composition.

Core recipe elaboration

The core recipe was elaborated through teoretical-experimental method based on the electric arc transfer coefficient of the alloying elements, determined through regresion equations specific to the product. For this goal, based on the teoretical recipe, we proceeded to manufacturing of laboratory experimental tubular wires.

For the manufactured batches were used base materials presented above and these were dosed and homogenised in order to correspond to filling and compacting requests of the profilated strips in order to produce tubular wires. Wires so obtained, figure 2, were tested for welding behaviour with CO_2 gas shield on a classic MIG-MAG machine.

The depositis considered proper throug weld behaviour analysis were spectral tested, the resuls obtained being used for realization of a product recipe (table 4).

The deposed layer structure is a feritic casting structure with complex carbides, evenly distributed, of Cr, W and Ti (fig. 3).

The roughness determined was: 51; 53; 52; 53; 50 HRC. The investigations effectuated on the deposed metal have evidentiated a good correspondence between the structure and the determined hardnesses.

Chemical symbol	STAS 1125/6, EH10,%	Determined
C	1-5	1,1
Cr	baza	baza
Fe	11-35	16,8
W	max 0,5	4.2
Ni	-	0,25
Ti	-	0,32
Mn	max 0,8	0,5
Si	max 1,7	0,75
S	-	0,02
P	-	0,02

Table 4. Chemical composition of the deposed metal

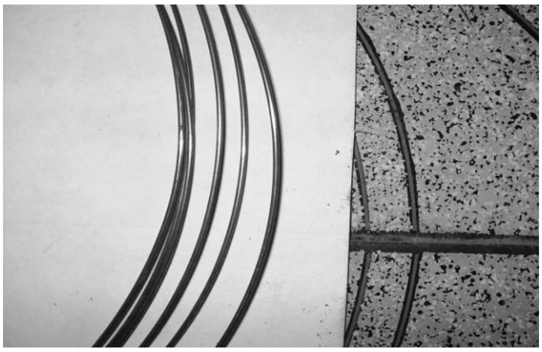

Fig.2. Tubular wire

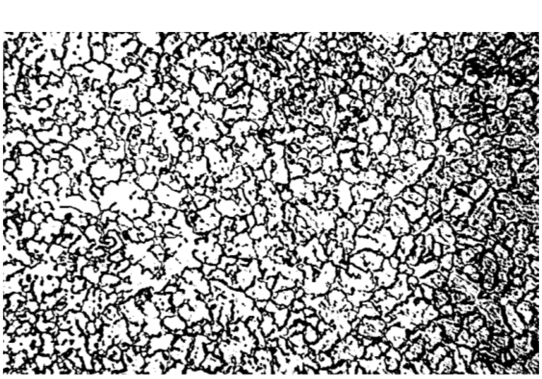

Fig. 3. MD 100 structure

3. FILLER MATERIAL TESTING

The experimental tubular wires tests were made on the product and on the deposed metal.

The weld claddding processes and the reliability of the welding machines are influenced by the specific properties of the elaborated wires like:

Filling coefficient was determined through weighting method, taking a sample of the produced wire coil of 0.5 kg, figure 6, that was flatened through pressing on a hydraulic press until complete opening, resulting a filling coefficient of 40 %.

Size variations were determined in 20 points on a 1 meter length of tubular wire, figure 7. The measurements were made perpendicular on the overlapping direction of the strip and parallel with it. Was determined that abatements are of 0.08mm with higher values on the parallel direction and values close to nominal diameter on perpendicular direction. The obtained values underline the enrollement in the prescribed tolerance.

Opening and breaking angle at bending was determined through bending test and observation for the holster braking moment.

4. CONCLUSION

- The experiments that were performed had as result, the achievement of a lab technology in order to produce filler materials of core filler wire type for WIG, MIG/MAG welding, and, also with plasma, alloyed through the core with chrome and wolfram.
- With the filler materials elaborated in this way, deposits made by alloys (super-alloys) were obtained, having superior characteristics in comparison with alloyed steels that are used nowadays in order to produce various tools for plastic deformations.
- The filler materials had been tested, depending on the exploitation conditions.

5. ACKNOWLEDGEMENTS

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