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Micro hardness variation of thermal spray coating layers on the inner cylindrical surfaces

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Abstract: Thermal sprayed layers deposited with couples of wires was investigated for obtain the dispersion of micro hardness values by the thickness of the layer. The layers were obtained by thermal spraying with electrical arc on internal cylindrical surfaces using different non-ferrous wires, like aluminum bronze and brass.

Keywords: couple of wires, micro hardness, thermal spraying

I. INTRODUCTION

In the last years the techniques of thermal spray gains area in restoration domains of machines parts. One of this machine parts are bearings, pieces that usually were attrite. To exchange these pieces with a new one lead on increasing the costs. Than, reworking of these types of pieces can be a solution.

II. TECHNIQUES AND MATERIALS USED FOR SPECIMENS

The specimens were obtained from some pieces with 140 mm internal diameter and 100 mm length. These pieces were electrical arc sprayed with two wires, like aluminum bronze and brass. The parameters of substrate, procedures and wires are inserted in Table 1.

The surface of substrate was turning, nut threaded and sandblasted to obtain a major surface roughness, which can increase the adherence of the deposited layers (Table 2). The parameters of thermal spraying procedure are inserted in Table 3. The wires used are inserted in Table 4.

On depositing the layers it were selected limiting conditions such as [1]:

- a small internal diameter of tube, which make heavy access of the spray gun to the surface who must be sprayed and lead to a non-rectangular angle of particles jet;
- take out the preheating of pieces, which can lead to a weak adherence between the substrate and the deposited layer;
- employ the compressed air as carrier gas, which lead on massive percent of oxides.

Table no. 1. The parameters of substrate, procedures and wires

Substrate			Procedure	Type of wires	
Material	Internal diameter, [mm]	Length, [mm]		Sprabronze AA	Laromet
				Diameter of wires – 1,6 [mm]	
OLT 35	140	100	Electrical arc thermal spraying	Cu – 90% Al – 9% Fe – 1%	Cu – 63% Zn – 37%

Table no. 2. The parameters of substrate preparation

Internal turning		Nut thread			Propeller pitch, [mm]
Rotations, [rot/min]	Lead, [mm/rot]	Rotations, [rot/min]	Lead, [mm/rot]	Depth of cut, [mm]	
160	0,125	200	1,5	1,621	1,5
Sandblast					
Grinding material	Type of sandblast machine		Granulation		Pressure, [bar]
Corundum	Compressed - air		F 13		4 – 6

Table no. 3. The parameters of thermal spraying procedure

Marking of specimens	Rotations, [rot/min]	Arc amperage, [A]	Arc voltage, [V]	Compressed – air pressure, [bar]	Spraying distance, [mm]
P1	200	200	28-32	2,4	130-150
P2	200	200	35-36	2,4	130-150
P3	200	200	28-32	2,4	130-150

Table no. 4. The type of wires used for deposited layers

P1	Sprabronze AA + Laromet
P2	Laromet
P3	Sprabronze AA

III. EXPERIMENTAL VALUES OF MICRO HARDNESS

From the sprayed pieces were cutting-off specimens for testing the hardness of the deposited layers up to sample from figure 1.

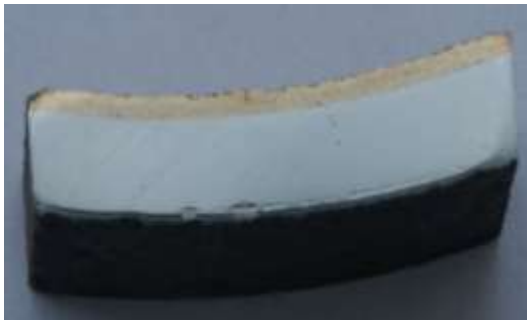

Figure no. 1. Specimen used for hardness tests.

These specimens were metallographic manufacturing and analyzed for establish the variation of Vickers micro hardness on layers thickness. The average values are summarizing in the charts from Figure 2, 3 and 4.

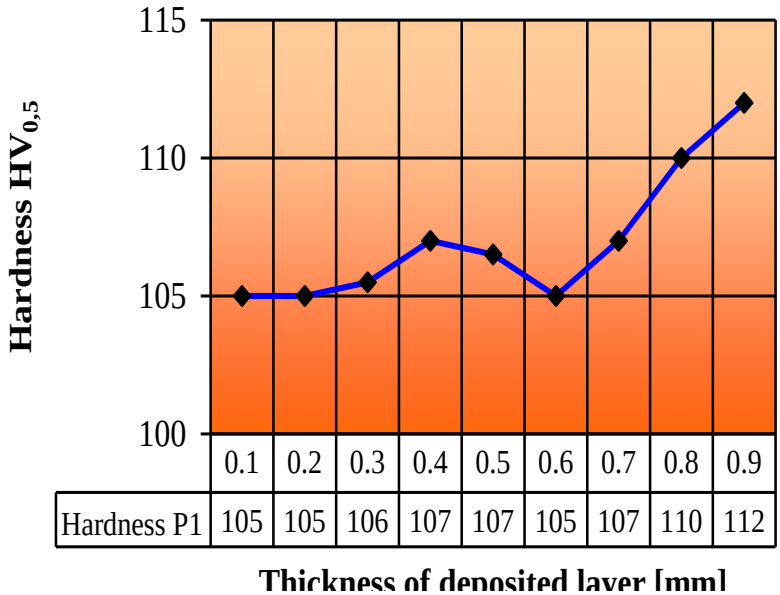

Figure no. 2. The variation of micro hardness for the P1 specimen

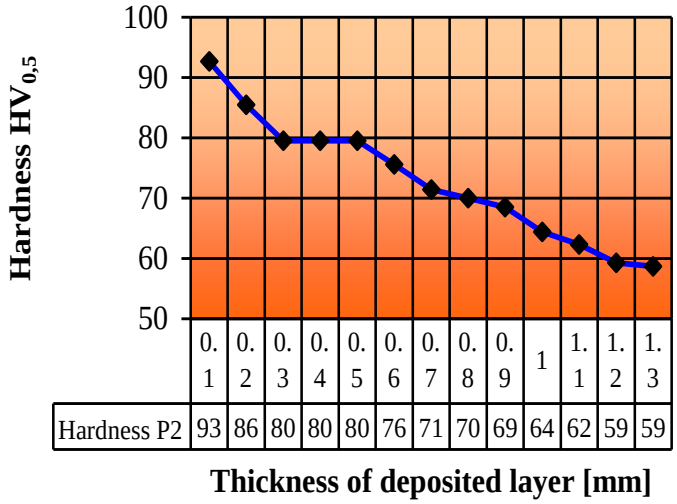

Figure no. 3. The variation of micro hardness for the P2 specimen

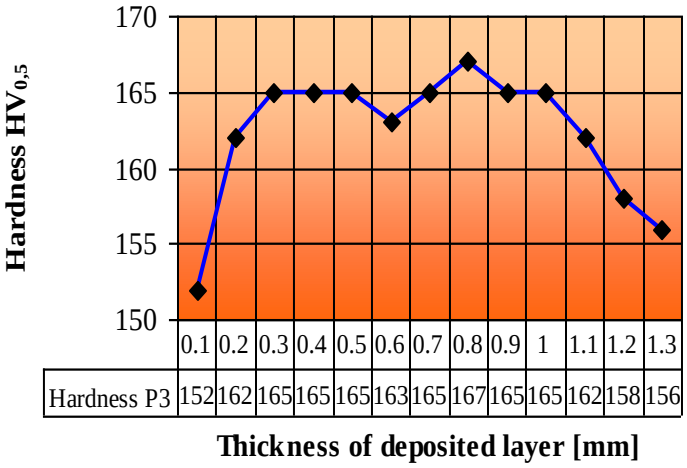

Figure no. 4. The variation of micro hardness for the P3 specimen

IV. CONCLUSION

From this charts it's easy to observe that all the values are much bigger than the hardness of these materials learned of in casting condition. The occurrences of oxides, the cold-hardening of sprayed particles are the determining factors for hardness increasing.

For the deposited layers on the P1 specimen it was used a combination between two wires, respective brass and aluminum bronze. For the deposited layers on the P2 specimen it was used brass wires and for the P3 specimen, aluminum bronze wires. It can be observed that the mean value from P1 specimen it's approximately the average values of the P2 and P3 specimens.

REFERENCES

[1] A.V. Petrica, *Contributions to increase the availability of spare type bore*, doctoral diss., University "Politehnica" Timisoara, 2004.