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ELABORATION OF SPECIAL TUBULAR RODS TYPED FILLER MATERIALS WITH COMPOSITE CORE IN ORDER TO INCREASE THE DURABILITY OF THE TECHNOLOGICAL EQUIPMENTS FOR THE CUTTERS USED IN ASPHALT RECYCLING

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Abstract: *This paper presents the researches performed in order to elaborate special filler materials for hard facing, of tubular rode type with composite core, that are able to coat using TIG method, in the active surfaces zone exposed to high wears from exploitation, of the milling cutters used for recycling the asphalt, and some thick layers that are Fe-Cr-V-Ti based, in order to increase their persistence*
Key words: *milling cutters, rods, composite core, coating*

1. INTRODUCTION

Nowadays, there are about 15 million kilometres of asphalted roads and highways worldwide, of which several hundreds of thousands need major rehabilitations. In the process of infrastructure rehabilitation are used some high productive and power equipments whose surfaces and active edges are exposed in exploitation, in contact with the soil in hard wears.

Now, various industrial producers dealt with the analysis of surfaces and active edges from different earthmovers, like backhoe scoops and blades that benefit nowadays of intense studies both in our country and abroad completed by modern manufacturing and recondition technologies (Iovănaş. & Iovănaş, 2006), (*** 2006), (2006 a).

Concerning the cutter equipments (Fig. 1) for asphalt recycling, namely the milling cutters, the technological processes of manufacturing and recondition used by the major industrial producers ensures the achievement of milling cutters with optimized reliability for constant and normal exploitation conditions in environments of homogeneous asphalt. However, in current practice, due to uneven wear of bituminous carpet coat and to the fact that the working environment is uneven most of the times, the phenomenon of working milling cutters blocking in spinning process appears.

Starting from these considerations, the main idea presented in this paper is the elaboration of new filler materials of tubular rode type with composite core by hard facing with protective, antiwear layers, in the milling cutters active surfaces zone.

2. TECHNOLOGY OF MANUFACTURING TUBULAR RODS WITH COMPOSITE CORE

Cutter equipments for asphalt recycling are generally high productive and power equipments and the surfaces, active edges of the technological equipments namely the teeth of asphalt recycling cutters are exposed to wear in the exploitation process. Thus, in contact with the soil appears a high abrasion typed wear under low and medium pressure as can be noticed (Fig 3 a, b).

In current practice due to an uneven wear of the bituminous carpet coat, the working environment is uneven most of the times and leads to working milling cutters blocking in spinning process. Thus, it can be asserted that besides the abrasion typed wear under low and medium pressure, a new factor that contributes to the abnormal wear of the milling cutters is underlined, namely their blocking in the spinning process under the action of the tangential force that appear in the working process (Fig. 3 c).

To ensure a homogeneous spinning of the milling cutters during operation is necessary to be ensured the optimal friction coefficients.

In this matter, the researches performed in this paper were focused on the elaboration of a milling cutters manufacturing technology in order to uncover the asphalt coating (Fig.2), in the bimetal version, from cheaper, tough, non alloyed steels coated only on the active zones (edges) with a layer hardened with CW, with specially elaborated tubular rods typed filler materials with composite core (Binchiciu & Iovănaş, 1992), (Iovanas, 2011).

For this procedure is necessary that the tungsten carbide particles (CW) have dimensions that are approximately equal with the coated layer width, about 0,8 – 1,0 mm. This fact requires the achievement of rods with coating characteristics that are controlled by the manufacturing process. Thus, in order to obtain thick layers, is required the achievement of flat products.

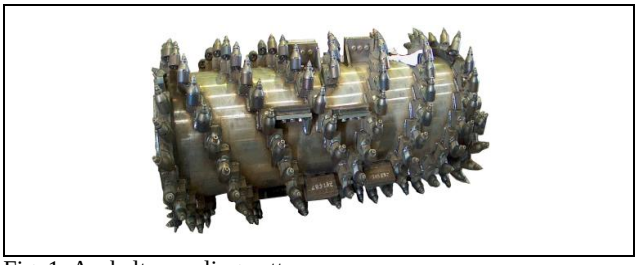

Fig. 1. Asphalt recycling cutter

Fig. 2. Different types of asphalt milling cutters

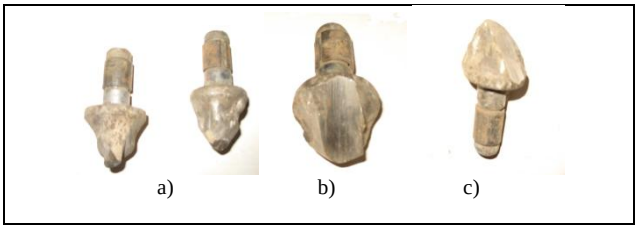

Fig. 3. Wearied milling cutters, a), b) abrasion wear under low and medium pressure, c) spinning blocking wear

In order to perform tubular rods for coating, it was used a flat bar steel with small thickness 0,1-0,2 mm and a 20 mm width, for a bull nosed band typed overlapping closure profile fig. 4, filler material with composite core according to a specially elaborated product recipe.

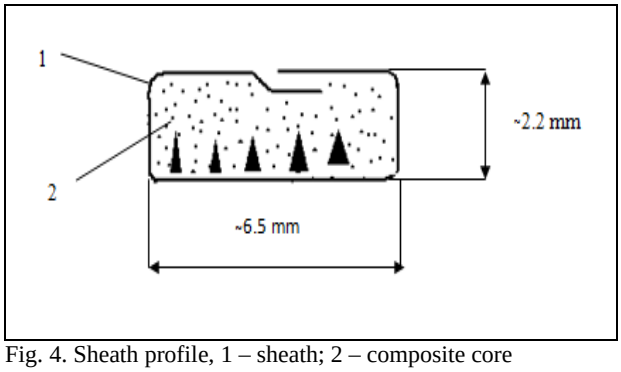

Fig. 4. Sheath profile, 1 – sheath; 2 – composite core

The tubular rods with composite core were symbolised as VTCr2, 5TiD, and the coatings were performed by the welding procedure WIG, on the active edges of the milling cutters head used to uncover the asphalt.

The chemical composition of the matrix that was spectral determined on the VTCr2, 5TiD tubular rods was analysed and the recipe that was used for the coated metal (MD) with the chemical composition from the Tab. 1 was validated.

A 12 kg lot was performed in these conditions, 2 kg for each dosage of VTCr2, 5TiD typed tubular and flat rods that were tested from the welding behaviour point of view and in order to determine the characteristics of the coated material (MD).

The hardness (Tab. 2) and structural characteristics of the matrix had been determined according to the current standards, on samples taken from the coated material in welded state, fitting in the alloying groups 1 and 2.

The martensitic - ferritic coating microstructure, with complex carbides of Cr, V and Ti is hardened with particles from W carbide grains that ensures a harsh surface with high friction coefficient that gives to the milling cutters heads a high resistance to exploitation conditions (Fig. 5, 6).

Electrode type	Chemical composition determined on the MD.	% mass
VTCr2.5TiD	C	0,32
	Mn	1,2
	Si	0,7
	P	0,02
	S	0,01
	Cr	25,3
	Ni	0,3
	V	0,3
	Mo	0,22
	Ti	0,15
	Other	Fe

Tab. 1. Chemical composition determined on the MD

Test type	Determined structure	MD hardness [HRC]
MD	Martensitic - ferritic with complex Cr, V and Ti carbides	55,53,51,52,56

Tab. 2. Sclerometric and structural results

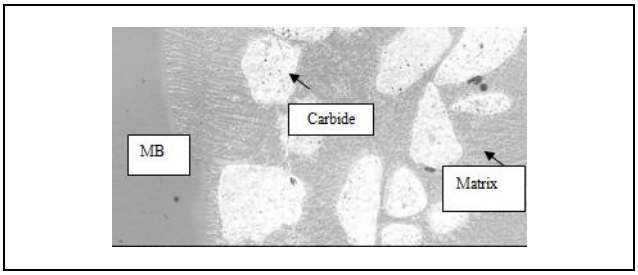

Fig. 5. Coating ensemble 10x

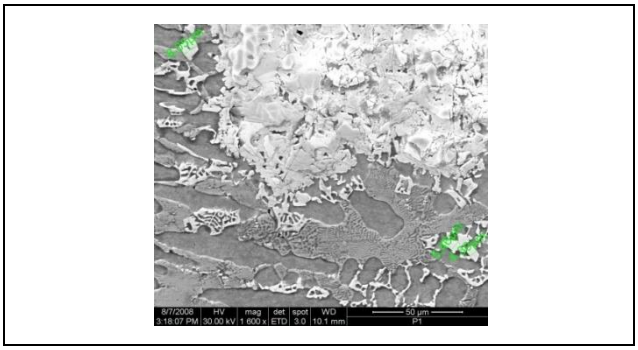

Fig. 6. Matrix interface implant SEM 1600x

3. CONCLUSION

- Conceiving, elaboration and achieving of a new type of tubular rod VTCr2,5TiD, that clad by hard facing using WIG procedure, a matrix with a martensitic-ferritic structure, rich in complex Cr, V and Ti carbides, resistant at high abrasion;
- Elaboration and achieving of a new cutting tooth product with high antiblocking protection in spinning ;
- A product recipe was elaborated on whose basis the tubular rods will be produced;
- Some milling cutters will be performed by coating, by welding with tubular rods specially conceived and achieved for this matter and which will equip the cutters used for asphalt recycling.

4. ACKNOWLEDGEMENTS

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