PLASMA SPRAYING COATING OF AlSi + 70% SiC

Mária LIČKOVÁ[1]* – Pavol TÖKÖLY[2] – Jozef ELIÁŠ

[1]*Ing. Mária Ličková, PhD., Faculty of Special Technology, Alexander Dubček University of Trenčin, Pri parku 19, 911 06 Trenčín*

[2]*Ing. Pavol Tököly, PhD., Faculty of Special Technology, Alexander Dubček University of Trenčín, Pri parku 19, 911 06 Trenčín*

[2]*Ing. Jozef Eliáš, PhD., Faculty of Special Technology, Alexander Dubček University of Trenčín, Pri parku 19, 911 06 Trenčín*

*Corresponding author E-mail address: maria.lickova@tnuni.sk

Abstract

The paper presents the concept of technological creation of coating carbides TiC. Spraying parameters deposition rate (APS) and porosity (CDS) were determined. Microstructure and wear resistans of the obtained coatings were showed and hardness of APS coating , the hardness of CDS coating.

Keywords: Plasma, Coating, Aluminum, Hardness Microstructure, Strength.

1 Introduction

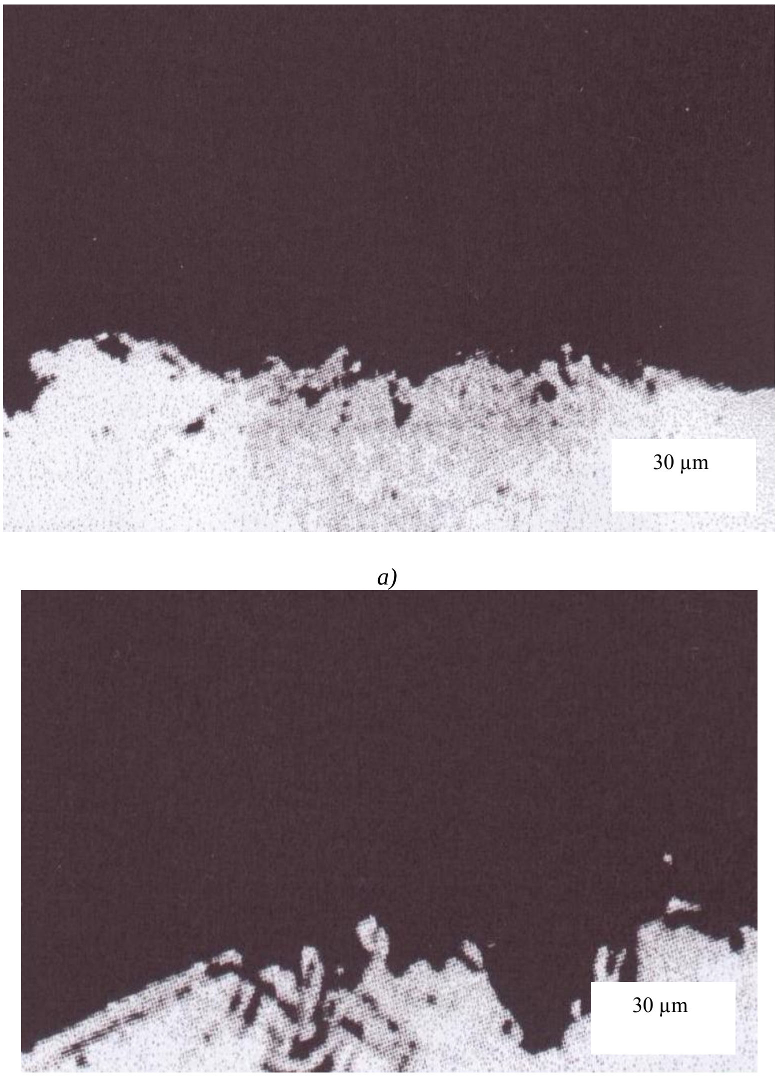
Various technologies of spraying protective coatings have been developed. The technology of thermal plasma arc spraying is one of the advanced technologies. It can be called plasma spraying of metallic and ceramic powder materials. Protective coatings are formed on the surfaces of machine parts and details when the thermal spraying method is employed. With regard to a high temperature of the plasma arc the method is suitable for high fusible materials spraying including oxides, carbides, nitrides, borides, cermets and others. Lightly fusible metals and some plastics can be sprayed in this way [1, 2, 3].

A high refractoriness or hot strenght, an increased hardness, corrosion resistance, resistance to abrasive or erosive wear or resistance to avoid other strains are common requirements in the present processing. It is necessary to apply advanced materials in order to meet the mentioned needs. Application of an appropriate base material (substrate) and a surface layer with special properties seem to be one of the possibilities when dealing with the problem [1, 2].

The functional coatings with improved quality as compared to the original parts from the compact materials can be applied by plasma spraying of various powder materials [1, 4, 5].

The technology of plasma spraying offers wide possibilities of applications in practice in electrotechnical, automotive, aircraft, textile and chemical industries.

The aim of this work was to improve the properties of AlSi + 70% SiC coatings, sprayed with two different methods APS and CDS processes. The powder AlSi + 70% SiC were produced by methods of synthesis particle size -50 + 100 mm. The metallographic analysis of the powder and the powder and the spraying coatings on different substrate material was examined by means of light microscopy (Fig. 1).



a)

b)

Fig. 1 *Microstructure AlSi + 70% SiC (a, b)*

Optimized parameters of APS process for AlSi + 70% SiC coatings at first were determined by means of splat test for different current and hydrogen values but with constant spray distance (110 mm). Than optimized parameters were determined by means of their deposition rate for same spraying regimes (Table 1). After that optimum spraying distance with constant current and hydrogen values was investigation (AlSi + 70% SiC: 600 A, 7 H_2 SLPM). At last for optimum spraying distance (AlSi + 70% SiC - 140 mm) different current values (AlSi + 70% SiC: 600 A) were examined. The coatings properties have been tested under abrasive wear conditions (Pin-on-Disk test). The porosity and hardness were defined with light microscopy combined with a computer - image analyzing system. Also the bond strength of the coatings have been tested. The specimens for testing under adhesive wear and corrosion properties were sprayed by APS and CDS method.

Table 1 *Deposition rate and splat test of AlSi + 70% SiC APS coating*

COATING	**H_2 SLPM**	**DEPOSITION RATE [A]**			
		400	**500**	**600**	**700**
AlSi + 70% SiC	6	20,12 (+/-)	22,19 (+/-)	23,61 (+/-)	23,38 (+/-)
	7	23,72 (+/-)	27,18 (+/-)	28,23 (+)	25,34 (+/+)
	8	21,18 (+)	23,27 (+/+)	19,84 (+/+)	19,01 (+/+)

2 Description of achieved results

Light microscope investigation of the shape and size of AlSi + 70% SiC powder showed that the particles have been distributed homogeneusly in AlSi matrix material, hardness of AlSi + 70% SiC powder $HV_{0,25} = 579 \pm 115$. Deposition rate of APS coatings is depending on current value and maximum datas for AlSi + 70% SiC (29,16) is corresponding a current value of 600 A. These results confirmed splat - test. Investigations showed, that the optimum spray distance for AlSi + 70% SiC 140 mm.

The APS coating sprayed with optimum parameters are characterized by a significant porosity AlSi + 70% SiC (1,89 ± 0,29 %). Porosity of CDS AlSi + 70% SiC (1,47 ± 0,57 %). The hard phase grains of SiC are distributed homogeniously in APS and CDS coating.

The hardness of APS coating is $HV_{0,25} = 365 \pm 385$ (AlSi + 70% SiC). The hardness of CDS coatings is $HV_{0,25} = 281 \pm 265$ (AlSi + 70% SiC). The optimum regimes for APS and CDS coatings (AlSi + 70% SiC) are given in table 2.

Table 2 *Optimum regimes for APS and CDS coating AlSi + 70% SiC*

COATING	**AlSi + 70% SiC**
Grain size of powder particle [mm]	
APS	-40+100
CDS	+40
Spray distance [µm]	
APS	140
CDS	270
Current [A]	600
H_2 SLPM (APS)	7
Ar SLPM (APS)	40
O_2 SLPM (CDS)	500
N_2 SLPM (CDS)	20
Propan SLPM (CDS)	55

3 Conclusion

The results of investigation allow using the APS coating sprayed with optimum parameters are characterized by a significant porosity AlSi + 70% SiC (1,89 ± 0,29 %). Porosity of CDS AlSi + 70% SiC (1,47 ± 0,57 %). The hard phase grains of SiC are distributed homogeniously in APS and CDS coating.

The hardness of APS coating is $HV_{0,25} = 365 \pm 385$ (AlSi + 70% SiC) and the hardness of CDS coating is $HV_{0,25} = 281 \pm 265$ (AlSi + 70% SiC).

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