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CONDITIONS OF THERMIC TREATMENT AND CHIMICO SUPERFICIAL INNARDS, WITH THE ADHIBITION ELECTRIC DISCHARGE IN IMPULSES

Pavel TOPALA[1]

ABSTRACT

In this work it is carried out factor analysis effected at surface thermal treatment details, prepared from steel, titanium and its alloys, using discharge pulses. It nas settled, that to achieve these treatments is necessary the volume head of fusion of materials processed into, may be little than energy density in interstice. Thickness of receiving stratum depends of surroundings components, thermo-physics properties of processing materials and the attacks number of plasma channel with processing surface.

KEYWORDS: plasma, elecroerosion

The researche looking the interaction of channels of plasma of electric discharge in impulses with the surfaces of electrodes demonstrated as as a matter of fact that the phenomenon of elecroerosion have two types of effects: the type I-the aperience on the surfaces of the electrodes of the electrodic"cold" staines that come from the aspirations and oxides from them, and produce the cleanliness of the impure surfaces, and the termic interaction with them, making changes in structure in thin layers (micrometres); type II- on the surface of the elctrodes, after „cold" stains come „warmth" staines that bring to the essential smelt of it, acompanied by vaporize fenomens and the prevalence of the electrodes materials in form of drops. If type II of ınteracton of plasma channel with electrodes surfaces find a large aplication on the dimentional process [1] and those to form layers for the deposition for compact materials [2], and for materials from powder, on actions of type I remain only like scientific finding, from which reason it is necessary the elucidation of the conditions and effects of superficial termic treatment and to elucidate is this a termic type of interaction or a chimico - termic.

Analizing the results obtained by author [3] was established that for the surfaces of the pieces a type I interaction with plasma channel, it is necessary to satisface such condition as :

$$Q < \frac{4W}{\pi d_c^2 \cdot S} \qquad (1)$$

$$Q = q\rho$$

where:

q is the specific worm of the smelt and ρ is the density of piece material; W- free energy interstice, d_c – the diameter of plasma channel and S- the dimension of interstice .

As you can observe from the relation (1), in the case when you know the energetic regime of processing, the dimensions of the interstice and the thermo – physic properties of the piece material can be determinate the diameter of plasma channel, that has the same dimension with the stamp on the processed surface . If the coefficient of the overlapping of the stamp k=0,5...n and the frequence of the electric dischages in impulse is f, an be determinate the productivity of the technological process is elation:

$$P = \frac{k\pi d^2 f}{4} \qquad (2)$$

In the work [4] was demonstrate that, the erozion processes together with the smelt and explosiv vaporisation of the electrodes materials for the most of metals allows studed

are aproximatly 10^{-7} s. So, to obtain the needed effects it is necessary to ensure the discharge impulses for very small time.

The effects from the electrodes surfaces are the function [3] the way to include a piece in a dischage circuit (as anode or cathode). These points were studed in [5] and was established that the impulses for a small time are "cathodes", and those for the long time are "anodes"-so, in cases of superficial termic treatment the piece will be in circuit like cathodes. In the case of the termic treatment of the piece implemented made from steel the hardness of it grow is 2...3 bigger, but from those from titanium is 2...5 bigger, for layers formed from 10 and more micro meters.

The depth of these layers has a maxim value of 3 passing for steel and five for titanium and its alloys.

The interaction of plasma channels with surface of electrodes' piece usualy can not have a termic character, and often a piece surface is reached with elements that are in the envarement and those from the anode – tool materials.

The depth of penetration [6] of these elements from superficial layer of the piece as of the impulse energy, as for the dimension of the interstice and can be exprimate in the relation:

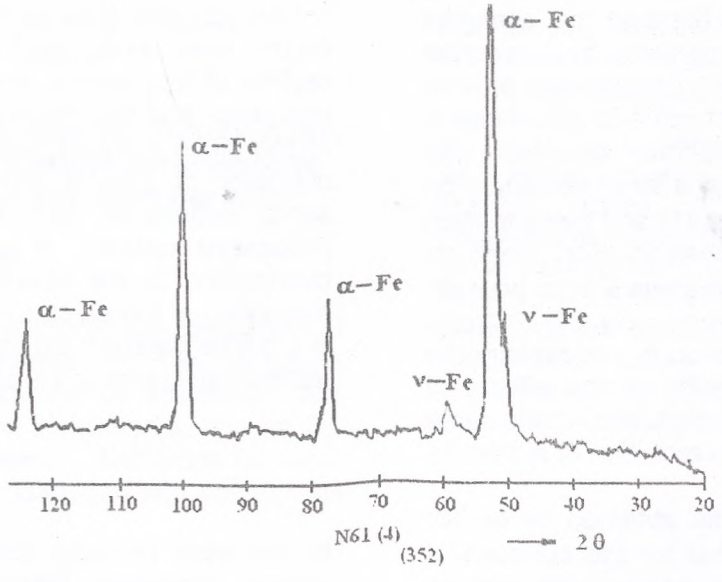
$$h = \frac{kW}{AS} \qquad (3)$$

$$W = \int_{o}^{\tau} U(t)I(t)dt$$

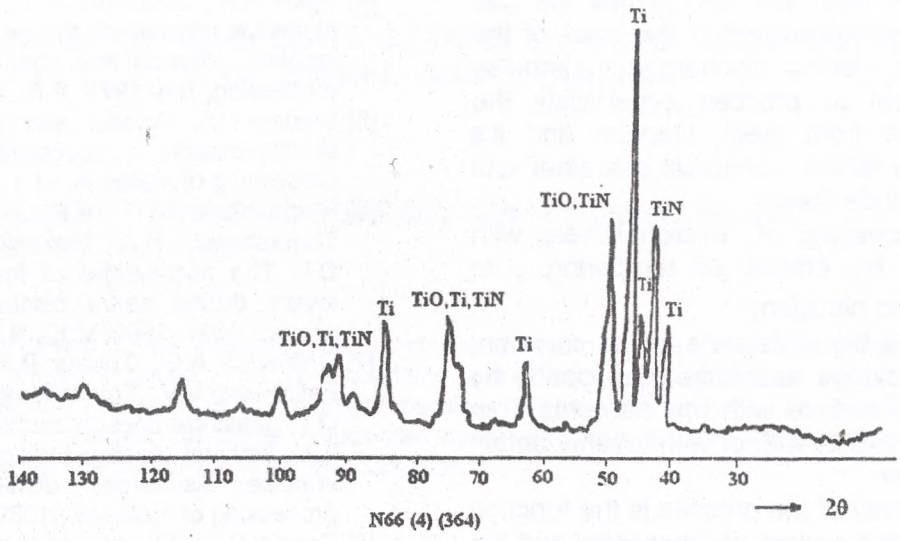
where - the free energy
emited in interstice during one discharge; U – the tension in interstice and I- the electric power ; τ - the duration of the impulse ; A – the area of a surface during a discharge ; S – the dimension of the interstice; k – a cocnstant value that are the properties of the proccesing material.

These layers can be used in different domains of engineering thanks to the fact that some of these have a high duration [3], but other have a high resistance.

From the technological point of view of the forming of the layers the termic treatment of the surfaces of the pieces implemented from thecnical steel or titanium or from its alloys [6,7,8], can be realize in usual atmosferical conditions. In normal conditions can be obtains chimical compounds of type $Fe-\gamma$ at the proccesing of the surfaces of the pieces implemented from surfaces of piecies made of steel - 45 and TiN made from pieces of alloys of titanium.

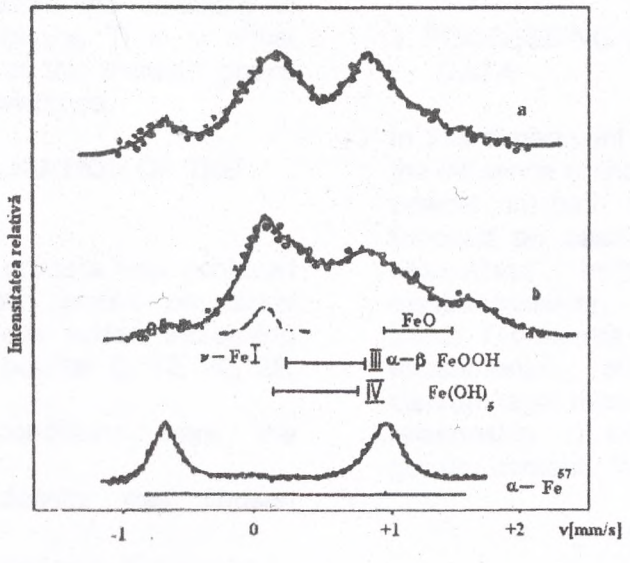


Pic.1a Difractogramme Steel-45 treaty superficial



Pic.1b Difractogramme titanium BT -1-0 treaty superficial

These phases were found with the help of rengenografic methode (see fig.1 a and b). In the case of introduction in interstice of the poweder particlesof small dimensions, they can be vaporisate and smelt, and transfere at the proccesing surface with the formation of micro meters layers, similar with the case of bombing with ion. As were mentionate earlier, even in short time electric discharges in impulse on the proccesing surface of the piece apear a layer of aproximatly $1\mu m$ of lliquide fase that ensure a superior aderation of the layer, comparative with the first oane. So, in the case of formation of the thin deposition of poweder of Pd or mixture of Ni-Cr [9] alow the increasing of the resistance to the corosion of the pieces to the 10 times. This is happened because in the superficial layer are intermetalese (fig.2) and oxides (Fe_2O_3, Fe_3O_4) and hidroxides (FeOOH) in amorfe state because the titanium is a very receptive metal to the oxygen.



Pic.2 Spectr Difroogram Mosbauyer of piece to carry out steel-3 treaty superficial.

Analyzing all that was said earlier we can make the conclusion that,in the case of the aplication in electric discharges in impulse with the goal to procces superficialy the pieces made from steel, titanium and it's alloys, has a termo – chimical character and we can conclude these:

- the increasing of microhardness with 2...5 times by effects of tempering , to cement and to nitrogen;

Was obtain a big resistance to the corosion, by forming oxides and hidroxides coats, by reaching the surface with the elements from electrodes - tool or with or with steams obtain from poweder ;

The productivity of the procces is the function of the energetic regime of proccesing and the frequence of electric disgharges in impulse

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AUTHORS

Doctor inginer, Pavel Topală, Universitatea "A.Russo", Bălți, R. Moldova, Str. Arțarilor 24, paveltopala@yahoo.com, (0231) 6-99-41, t.mob. (373)079622510