OPPORTUNITIES OF INFLUENCE OF PLASMA STREAMS FORMED IN IKA WITH CONTINUS NORKING GAS FILLING EN THE SURFACE OF MATERIALES

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The results of the investigation of influence of plasma stream formed in IKA with continuous working gas filling on the surface of stainless steel 12X18H10T and aluminum are given in this article. It is shown here that the effect of influence of plasma stream on the surface of materials depends on the way of working gas filling. There is the comparison of influence of plasma stream formed in plasma accelerator with impulse and continuous working gas filling.

Introduction

It is known that treatment of the surface of materials with impulse pencils of charged particles advantageously differs from the way of continuous irradiation by great economy and effectiveness of the process of interaction. Among the ways of treatment of metals and alloys with the aim of improving their physico-mechanical properties plasma influence is one of the modern and perspective ways in the area of stuff knowledge. In the process of plasma treatment of materials heating of the sample with the succeeding surface melting takes place. Numerical model you can find in heating model [1].

The most effective sources of plasma stream creation are coaxial plasma accelerators that can be conventionally divided in accelerators with impulse [2] and continuous [3] working gas filling. These accelerators have cone peculiarities of techniques of plasma stream acceleration forming. They differ in parameters, energy-content and duration of influence.

Systematical researches on plasma treatment of the materials were made, as a rule, on impulse working gas accelerators[4].

In this work you can find the results of plasma stream influence which is formed in impulse coaxial accelerator with continuous working gas filling.

Results of the researches

The experiments on interaction of plasma stream with surface of stainless steel and aluminum took place on IKA with continuous working gas filling (see [5]).

Results of the investigation shaved that structure and mechanical properties of surface layers of irradiated material are defined not only by plasma stream parameters and energy-content but by techniques of forming and accelerating of the clot.

Experimental data of influence of plasma stream formed in 2 types of accelerators: with impulse and continuous working gas filling confirm it (fig.1).

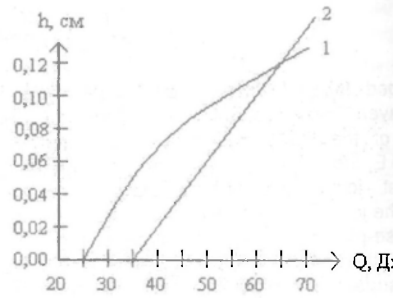

Fig. 1. Dependence of maximum depth of melting on plasma stream density.

1. for the accelerator with impulse working gas filling.
2. for the accelerator with continuous working gas filling.

Analysis of this dependence shows that plasma steam density at which the process of surface melting start is different: Q=25 joule/cm^2 and Q=35 joule/cm^2. It is necessary t$_0$ take into account that while using impulse working gas filling accelerator there is a stage of "vapour-liquid" at energy density Q=70 joule/cm^2 and while using continuous working gas filling accelerator the second stage occurs at density Q=80 joule/cm^2.

Results of influence of plasma steam formed in both accelerators on the surface of stainless steel 12X18H10T (see fig 2) show that types of

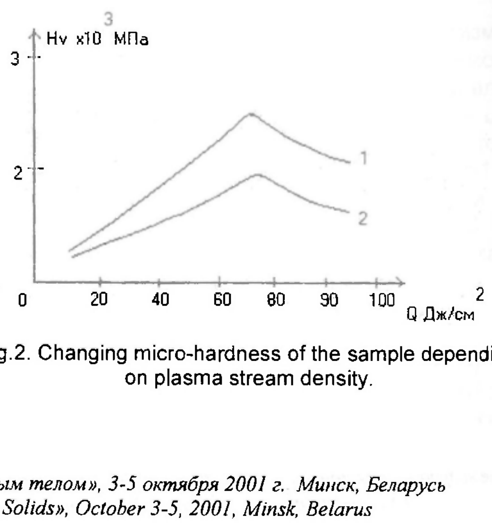

Fig.2. Changing micro-hardness of the sample depending on plasma stream density.

influence of these streams on the surface of irradiated sample are different.

Using Vickers's method we measured micro-hardness. The results showed micro-hardness increases to 20%, that is an evidence of increasing dislocation density on by-surface layers. At some definite value of plasma stream energy (120 joule/cm^2) consequent destruction of irradiated layer of the sample takes place, that leads to micro-hardness reducing.

As to both accelerators only some qualitative coincidence of the results of micro-hardness measurement can be observed.

Having analyzed fig. 3 we found out that uneven distribution of micro-hardness. on the surface of sample of stainless 12X18H10T took place.

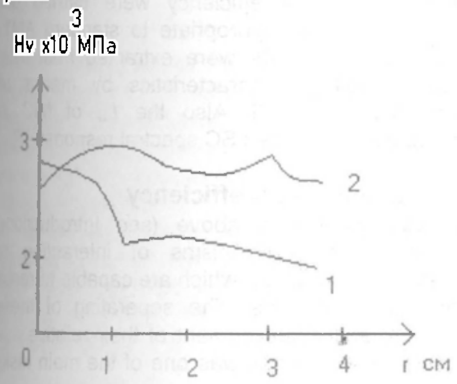

Fig.3. Changing micro-hardness on the sample surface.

Structural investigations of steel 12X18H10T made by (1) methods of optic metallographics, (2) spectroscopy and (3) X-Rays structural analysis showed not great changing of percentage content of Cu, Mn, Na as against the initial sample, that could be explained by spraying of separate components of the complicated substances.

Conclusion

The results obtained can be explained. At the relatively small densities (Q=30 joule/cm^2) plasma stream does not influence strongly on heating and physical properties of aluminum sample, they are usually considered as classical models of physics. At energy density 30-90 joule/cm^2;t is necessary to take into account the sample properties at some depth, i.e. inside the target. Further increasing of plasma stream energy Q>90 joule/cm^2 leads to complication of the processes with changing all the sample properties. From our point of view the observed divergence of the research results for 2 types of accelerators can be explained by dynamics of accumulation of energy and acceleration mechanism.

Currently opportunities of impulse coaxial accelerator with continuos working gas filling for influence on material surfaces considering outer magnetic field are analysed. Further researches are devoted to studying such epportunifes.

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