

PHYSICAL AND CHEMICAL PROCESSES DURING THE MACHINING BY MEANS OF THE ELECTRO-EROSIVE METHOD

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Abstract: We have analyzed the processes that take place in the interstice and in the electrode surfaces during machining by electro-erosion. It is demonstrated that machining by electro-erosion is accompanied by a series of physical phenomena which occur at high temperature; simultaneously a series of chemical phenomena develop and are produced. Chemical phenomena contribute to the formation of new structures and compounds that cannot be obtained under ordinary conditions.

Keywords: electro-erosion, deposits, effects, chemical structure, electrodes, oxidation, hydrooxidation, diffusion processes, electrophysical, electrochemical.

1. INTRODUCTION

The phenomenon of electro-erosion is basic for many methods of material processing using electric discharges in impulse (EDI) some of these methods are: dimensional processing by means of electro-erosion [1, 26], formation of compact material deposits [2, 3] and powder [2, 3, 4], modification of surface microgeometry, modification of chemical structure and composition in piece surface strata [4, 5, 6, 10, 12, 14, 20].

All these methods make use of the thermal energy generated by electric discharges in impulse, electric fields energy generated by them when electroerosive effects are realized, the convective effects that appear when powder and compact material deposits are formed, diffusion effects of elements from the working medium or those that derive from the material of the opposite electrode in the electrode active surfaces, etc. It is important to mention that practically all these processing methods are accompanied by structure and chemical composition modifications in the surface strata. The chemical composition is modified either by implanting medium elements of one of the electrodes in the surface or by a previous deposit on the surface that is subjected to processing or a deposit formed by material transfer from the surface of one of the electrodes. In all these cases, the chemical composition modification is

accompanied by diffusion processes [4, 5, 8, 11, 15] and correspondingly by a mixture depending on the physical state of the materials in which the processing takes place.

2. ANALYSIS OF SCIENTIFIC RESULTS OBTAINED NOWADAYS CONCERNING THE FORMATION OF SURFACE STRATA BY THE APPLICATION OF EDI

According to the conditions described in the paper [4, 15, 24, 25] the effective diffusion coefficient of elements D_{ef} when electric discharges are applied may be determined by the relation:

$$D_{ef} = N(D_1 t_1 + D_2 t_2), \quad (1)$$

in which N is the number of processing cycles; D_1 and D_2 are correspondingly the diffusion coefficients throughout the electric discharge in impulse and during the interval between the two discharges; t_1 and t_2 are the periods of duration of electric discharges in impulse and of the pause.

It is mentioned in some of the papers that deal with formation of deposited strata [2, 3, 3, 7, 9, 10, 14] that this process is accompanied by micrometallurgic processes but these processes are obscure under this expression. It is logical to ask the question: „Which of the electro-chemical processes accompany electroerosive phenomena?”