PRINCIPLES OF DESIGNING TECHNOLOGY OF PROCESSING THROUGH COMPLEX EROSION

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ABSTRACT: The process of processing through complex erosion is influenced by a large number of parameters and factors acting interrelatedly and influencing each other in order to achieve stability of the processing and achievement of the fina technological features. The quantities characterizing processing, imposed on it and having constant values represent process parameters.The quantities involved in the development of the mechanism of processing through complex erosion and contributing to the technological characteristics are factors.

KEY WORDS: complex erosion, intensity, tension voltage, current density.

In developing the technological process of dimensional processing through complex erosion are envisaged constructive and dimensional characteristics of the piece to be performed, conditions of shape and dimensional accuracy imposed, surface roughness of processed surfaces and the nature of the piece material .In principle,the sequence of designing the processing technology is summarized in the following.

Depending on the type of piece it is needed the application of a particular method of processing (cutting, grinding, profiling) and it is chosen the appropriate processing equipment: cutting machine with electrode disc or tape, grinding machine or profiling machine through complex erosion.

The tension voltage U is the factor that determines the stability of the processing and is most often used in the management of automatic control systems.

The common values of voltage U are 10-30 V its adjustment being made through modifying the nature of the electrical circuit or through power supply.

To these values of the tension voltage have been developed both anode Dissolution Processes (DA) and electric discharge pulse (DEI). When exceeding the maximum voltage it becomes possible between OT and OP quasi-stationary arc discharge, leading to instability in the processing, with a final negative result on the technological characteristics.

The intensity of electric current I

Along voltage, the intensity of electric current I is a determining factor of the processing by EEC.

The intensity of the current depends on the external characteristic of the power supply, which is relatively rigid and causes to increase the intensity, voltage having an insignificant decrease.

Increase of the intensity I is due to the increase of pressure in SL, followed by:

- increase of the number of electric discharge in impulse so that a higher current should be distributed in several simultaneous discharges in impulse. In this case, the discharge power per impulse remains constant and therefore roughness of machined object does not suffer;
- the number of electric discharge in impulse is constant, in which case the individual discharge power increases, which results in obtaining larger craters (in diameter and depth) and thus to the alteration of the processing results. There is the possibility that

proved correct on the basis of experimental research.

To establish working arrangements is selected an optimal current density j [A / mm^2] for each operation (roughing, semi-finishing and finishing) if rectification or profiling is made. Depending on the size of the area of interaction, Ai [mm2], current is calculated:

$$I = A_i \cdot j \qquad [A] \qquad (1)$$

Closely related to I, the current density j adjusts the share of elementary, fundamental, processes, in SL:

- When j is low, the electrochemical phenomenon prevails. Share of discharge in impulse is low (and if the voltage U is low, they really can not form) and give a very good result of processing in terms of geometric parameters and surface condition but QOP productivity is reduced.
- When j is high, electrical erosion ensures removal of material by thermal effect, which increases productivity QOP but decreases the quality characteristics (geometric and surface state parameters).
- When j is very high , removing material becomes uncontrolled, there are short-circuits (if U is low) or discharges in stationary arc (if U is high), which through the thermal effect mentioned above leads to the degradation of the object of transfer OT and processed object OP by mass or volume change.

The interaction surface Ai,between OM and OP is based on object- electrode pair to be processed.

For the case of the cutting with disc electrode and the piece to be processed of circular or rectangular shape , the surface area of interaction, in mm2, is determined by the relation:

$$A_i = \frac{\pi^2 D\varphi}{720}\left(g + 2g_0\right) \qquad (2)$$

wherein: D is the diameter of the disc in mm; φ - angle in degrees from the center; g - the thickness of the disc in mm; g_0 – lateral sliding due to leakage current
($2g_0$ = 0.1 ... 0.3 mm).

The central angle φ can be calculated using the formula:

$$\varphi = \mathrm{arctg}\,\frac{d}{D}, \qquad (3)$$

where d is the diameter or the side in mm of the piece to be cut.

In the case of profiling with tool disc the area of interaction surface is expressed by the equation:

$$A_i = \frac{\pi D\varphi}{360}\,p_c \qquad (4)$$

ie the product of the arc length of contact between the disc and the piece and the perimeter of profile disc contour pc.

In the case of yielding with electrode band , the area Ai is calculated by the expression:

$$A_i = \frac{\pi \cdot d\left(g + 2g_0\right)}{2}, \qquad (5)$$

where d, g, g_0 are as defined above.

For filiform electrode, Ai has the form:

$$A_i = \frac{\pi \cdot \Phi d}{2}, \qquad (6)$$

where Φ is the diameter of the thread.

Tension is adjusted so as to ensure an unstable regime without moving towards arc discharging. The voltage and current values can also be selected from tables or nomograms, depending on the procedure, material and size of the piece and on the operation executed. When yielding, we are interested especially in a processing time as short as possible. Voltage and current may have higher values. In this case, the processing time is determined by the relation:

$$t = \frac{A_i g}{kI} \ [\text{min}] \qquad (7)$$

wherein A_i and g have the known meanings; I is current in amperes; k-constant k given in tables in mm^3/Amin (for steels k = 6 ... 12).

To obtain a peripheral or tangential speed of the electrode set in tables or nomograms are adequately adjusted the speed of the main shaft.

The liquid supply system is chosen(spray or immersion).

In order to get a little roughness ,the power scheme is calculated ,resistive or with inductive circuit, setting the resistance or inductance value which will be introduced in series with the working space.

At rectification and profiling operations shall be adopted a processing in several phases. For surface roughness of Ra = 0.6 ... 3.2 micrometres the phases are of : roughing, semi-finishing, finishing at the values indicated in the tables or nomograms. At a roughness Ra = 3.2 ... 25 mm, processing can be done in two or even in a single phase.

When processing metal carbides we will adopt finer processing arrangements and other measures (immersioning, inductive circuits), given their susceptibility to fissures.

For determining the indicative parameters of the processing regime and of some indicators can be used technological charts.

The main functions of the object of transfer being of introducing primary energy into the workspace, the macroscopic location of the action of electric discharges and of anodic dissolution at the surface of the object to be processed, its design being of particular importance.

The electrodes are made of cheap materials in general, such as a general use steel, pig-iron, non-ferrous rarely. The electrodes must be executed with precision due to the nature of the operation. For grinding and profiling, the electrodes must have a high dimensional and form accuracy. Although there are some couples OT-OP that positively influence processing - productivity, accuracy, low OT wear, in processing through complex erosion must be judiciously justified their selection of these materials which are deficient.The execution of the electrodes is achieved by splinting, stamping, cutting.

The execution technology of the electrode is established and it is executed.

The advance system is adjusted according to the value of advance speed required to the operation to be executed.

During the service of the machines of processing through complex erosion should be paid special attention to the technical work safety measures. Machines will be insured against electrocution (adequate grounding), against liquid splashes and equipped with devices of exhausting gases from the work area.

Serving personnel will be trained in all technical work safety rules imposed by operation of electrical installations. It is recommended that staff have appropriate equipment (gowns, coveralls, goggles, rubber gloves for hand protection, etc.).

CONCLUSIONS:

The factors influencing the processing of EEC act interrelatedly and influence each other. They can be grouped into factors of influence determining for other factors and influencing factors in turn determined by others. This complexity of the factors and their mutual influences demonstrates the complex nature of the EEC and is an explanation for the complexity of models necessary for the theoretical analysis of processing.

In conclusion, because of the particular character of processing through EEC, fundamental phenomena conducted in SL depend on a whole range of parameters and factors acting simultaneously in a dynamic interdependence.

Depending on the variation of these parameters and factors are influenced, in turn, the results of the processing as follows:

- The global erosive effect;
- The share of elementary processes;
- the stability of the processing;
- the global technological features.

In conclusion, the main processes occurring in the EEC processing take place within the system, limited by OP, OT and LL.

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