THE ANALYSIS DIRECTIONS OF CUSTOMIZE BY PROCESSING COMPLEX EROSION RESULT AT THE STUDY OF THERMICAL FIELD

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ABSTRACT

The study of the thermical field in the processing by complex erosion offer the possibility of the realization by theoretical research and application who’s complete assembly of knowledge in domain. In this study is following continuing of technological and phenomenological hypothesis who’s discovered, and aspects to given new information at processing condition and results like opening new direction of research.

Keywords: complex erosion, thermic field, object to be processed, transfer object.

1. GENERAL POINTS OF VIEW

Dimensional processing trough complex erosion is a technological field always up-to-date permanently leaving an open door for attempting to know its mysteries. It is a field that makes the Polytechnic University of Timisoara proud and that is why any research regarding this field demands strict, solid rules for achieving good results and approaching the new. It is a duty of honor for anyone who tries this to maintain the level imposed by previous researchers.

Thus, the study of the thermic field processed by complex erosion, a using this procedure, which has been rarely used till now, offered the possibility of remarkable theoretic and experimental research. These were made in order to confirm some previous technological and phenomenological hypothesis and also to clear some aspects that will give new information regarding the conditions and results of processing and will also give new directions and possibilities in research.

The research through modeling using the finit element method has a great importance in the study of thermic field. This approach is due to the fact that through conventional methods using the current means of measuring the very high temperature which are developed in the processing area can not be measured.

2. THE ANALYSIS OF THE OPTIMIZATIONS OPTIONS

a) Singular discharge.

To create an overview of the thermic field as a factor of the processing we analyze the evolution of the temperature from the working area at 10293 K (Fig. 1 and 2) and 20293 K (Fig. 3 and 4).

No matter the temperature of the working area, we can observe that for a singular discharge the variation of the thermic field has the same shape, the differences appear in the case of temperature gradients, the higher the initial temperature the higher they are.

We study the graphic of the thermic field we will observe a uniform distribution of the propagation time, it has an abrupt descendent slope in the first part of the interval, the closer the temperature gets to the one of the environment the flatter it becomes. Also the shape of propagation the graphic above confirms the hypothesis of the drop type thermic field.

We ascertain that the temperature variation, measured in nods that are symmetrical to the impulse electrical discharge point (because it is a border zone of the processed object), is influenced by the heat exchange, and the curve it isn’t ascendant anymore.

b) Two simultaneous discharges

Graphic 5 represents the thermic field for two simultaneous discharges and an
Fig. 1. The distribution of the thermic field (10293K) step 1

Fig. 2. The distribution of the thermic field (10293K) step 2
for this case we need to mention that we didn't take into account the real thermic state for the moment of discharge, advance ratio and in graphic 6 an advance cota. We observe that heat distribution has a much higher temperature gradient compared to the evolution regarding the singular discharge and ay others. The size of the thermic field isn't influenced by the penetration depth, but for this case we need to mention that we didn't take into account the real thermic state for the moment of discharge.
Fig. 5. Distribution of the thermic field an advance cota an advance cota by 4 mm.

Fig. 6. Distribution of the thermic field an advance cota an advance cota by 10 mm.
Table 1. The heat distribution ratio estimation developed in the primary thermodynamic system

<table>
<thead>
<tr>
<th>The study mode</th>
<th>Impuls electrical discharge zone temperature [K]</th>
<th>Intial temperature distributed in the processed object [K]</th>
<th>The heat transmitted in the processed object [%]</th>
<th>The heat transmitted from the processed object microsystem [%]</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singular</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impuls electrical discharge and free cooling</td>
<td>10293</td>
<td>10241</td>
<td>99,49</td>
<td>0,51</td>
<td></td>
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<tr>
<td>Singular</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Impuls electrical discharge and forced cooling</td>
<td>10293</td>
<td>9615</td>
<td>93,41</td>
<td>6,59</td>
<td></td>
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<tr>
<td></td>
<td>15293</td>
<td>14249</td>
<td>93,17</td>
<td>6,73</td>
<td></td>
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<tr>
<td></td>
<td>20293</td>
<td>18937</td>
<td>93,31</td>
<td>6,69</td>
<td></td>
</tr>
<tr>
<td>Two simultaneous impuls electrical discharges</td>
<td>15293</td>
<td>14944</td>
<td>97,71</td>
<td>2,29</td>
<td>The values are correlated to one of the two discharges</td>
</tr>
</tbody>
</table>

3. CONCLUSIONS REGARDING THE STUDY OF THE THERMIC FIELD IN COMPLEX EROSION PROCESSING

Analyzing the results obtained by modeling using the method of the finite element and linking with the previous related research, we can conclude the following:

a) The heat distribution ratio estimation in the object to be taken over microyistem

The distribution of the thermic field gives us the possibility to have the heat distribution ratio estimation developed in the primary thermodynamic system, like an effect of the impulse electrical discharge.

Taking into account that the heat flow is proportional with the temperature variation, no matter where it is located, the estimated values of the heat developed inside the object that needs to be processed and the one for the heat transmitted trough the interaction between this one and the other microsystems (including heat loss) are centered in table 1. We observe with the help of the table that most of the heat is transferred to the processed object no matter what kind of energetically processing we choose, the maximum value transmitted to the exterior of the object is approximately 7% of the total heat developed is the system during the impulse electrical discharge. So, the previous research should be oriented to the stored heat in the microsystem of the processed object. We notice that in the case of free cooling, to be more exact in processing with two simultaneous impulse electrical discharges, the heat transmitted to the exterior of the microsystem of the processed object has higher values than the one with singular discharge and forced cooling, so we conclude:

- In the transfer object’s technological process of fabrication it is necessary for a floating operation to be introduced, which favors the growth of the processing precision and also reducement of the cutting width
- Choosing the debit of the liquid we work with, of the shape and of the jet conducting module, so that it will favour free cooling

b) The evolution of the thermic field cvasidentical regarding the shape and different regarding the heat distribution

According to table 1 for every processing mode/regime used, the loss of heat is practically equivalent, and the shape of the thermic field is practically cvasidentical. But there are differences regarding the temperature’s value distribution, the evolution of the field are made using higher gradients in rougher processing regimes and using lower gradients in softer processing regimes.
So the processing regime mustn’t be chosen out of energy loss grounds but exclusively out of the precision imposed on processing and the quality of the processed surfaces grounds.

c) The three-dimensional evolution of the thermic field
The study of the thermic field, for the chosen technological mode, for a singular impulse electrical discharge confirms the emitted hypothesis regarding drop-like shape. In this case the heat is centered on the object that needs to be processed. Because, energetically speaking, the optimal mode is the drop-like shape, it is the recommended one as long as it is possible (the object to be processed has a transversal forward processing move /the transferred object has a forward vertical and longitudinal positioning move)

d) The addiction of the thermic field towards the number of simultaneous discharges
The thermic field was studied in the case of a singular impulse electrical discharge and in the case of two simultaneous discharges. Given the conditions that the number of a finite elements, obtained by discharges it is almost the same in both cases, we can observe that only one finite element has the thermic field in its structure for one discharge, and the thermic field has three finite elements fore one discharge
Some subsequent research is required for finding technological solutions that will make simultaneous discharges to appear.
In this way we can influence the growth of the processing productivity with approximately 300 %, only in ideal conditions that will make two simultaneous discharges to appear exclusively during the entire processing activity

e) The dimension of the crater
Using the study of the thermic field for one discharge, knowing the dimensions of the finite element we can determine the value of the crater’s diameter and also its depth.
In the analyzed situation (graphic 4) the diameter of the crater is 2.04 mm and its depth is 0.88 mm, confirming the estimations as resulted from prior experimental activities. Favorable premises are created for establishing a direct relation between status parameters of the surfaces and process parameters.

REFERENCES


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