

ASPECTS OF THE EVOLUTION OF THE THERMIC FIELD IN THE CASE OF COMPLEX EROSION PROCESSING OF THE RAILROAD TRACKS

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ABSTRACT

Is considered object of the transfer, a disc on object to processing a railway of finit length. Is analyzing evolution of the thermal field at his cutting by complex erosion, emphasizing shape of the field in different moments of the processing and comply with this depth of penetration.

KEYWORDS: complex erosion, thermic field, railroad tracks, object to be processed, transfer object.

1. GENERAL CONSIDERATIONS

The complex erosion processing produces high temperatures on the surface of the object to be processed phenomenon which leads to processes like heating, melting and vaporization of the material micro volumes. That is why an analysis of the processing system is needed, made not only from the technological processes point of view but also from the thermal processes point of view.

In quantum preponderant, the complex erosion processing system is made of impulse electrical discharges, which produces the transformation of the electrical energy into thermal energy, leading to temperatures between 10000 and 15000K. The impulse electrical discharge produces a point-like and instantaneous heat source on the surface of the anode. The impulse electrical discharge requires a consumption of electrical energy, and so it is necessary to determine the electrical energy introduced into the primary thermodynamic system, that determines a growth of the internal energy in an area of the system trough a irreversible transformation. This area is a source of heat. So we conclude that, from the point-like localization of the thermic energy and in respect to that of the high temperatures, the heat is transmitted through conduction in the finite/delimited volume of the object to be processed, that reaches to a higher temperature that the one of the surrounding environment and in that

moment it begins to yield heat trough convection and radiation processes.

Determining the heat developed in a very short period of time around the random point M, does not offer the general image of the amount of heat developed on the entire surfaces that is processed, which is why we have to determine the thermic field when using the complex erosion processing.

Between the components of the primary thermodynamic system and also between the components of its microsystems there are temperature differences, because of this an energy yielding takes place, the energy being the heat. The heat transferred in a time unit represents the thermic flux transmitted trough that surface and the study of the heat transfer is made in order to determine the vectorial field $q = q(\tau, r)$ by using the laws specific to all ways of transmitting the heat.

Taking into account that the objective of the complex erosion processing is to remove certain material from the object to be processed, the study of the influence of the thermic field is necessary to be made starting from the microsystem of the object to be processed.

2. STRUCTURES OF THE MICROSYSTEM OF THE OBJECT TO BE PROCESSED

The requirements of the industry claimed for new technological methods and constructive solutions to be found, ones that will best fulfill

the needs and the evolution of the thermic field can be analyzed as it follows:

- electrode band processing,
- processing profiled after the contour of the filamentary electrode,
- processing with the transfer object a disk
- processing with multiple transfer object.

The technological processing systems, which are using one of the constructive solutions of the object, could be:

- the flow cutting in the case of cylindrical pieces,
- the flow cutting in the case of pipes with a big diameter,
- the flow cutting in the case of the shaped parts,
- making narrow gaps in tubular pieces,
- making narrow slips in profiled pieces,
- adjusting the cutting tool,
- adjusting flat surfaces,
- adjusting profiled surfaces,
- bold surfaces processing in the case of the revolution objects/parts.

In this study we want analyze some aspects of the thermic field in the case of the processing of a disk as the transfer object, for cutting railroad tracks (Fig. 1).

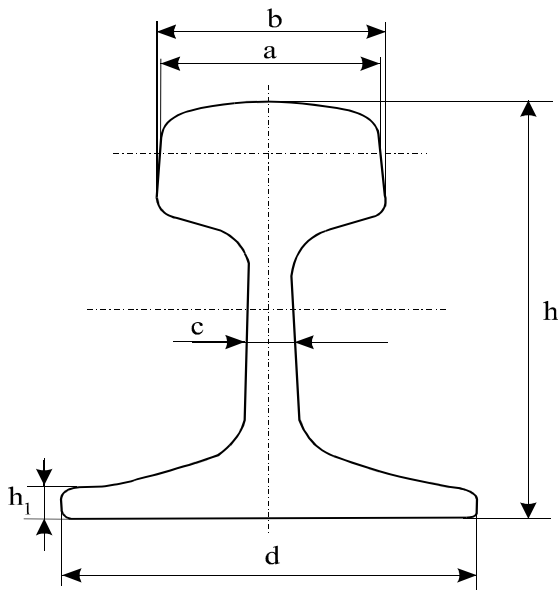


Fig. 1 The representation of the profile of the object to be processed – railroad track

3. FLOW CUTTING – OBJECT TO BE PROCESSED – RAILROAD TRACK

We use as the transfer object a cylindrical disk with the diameter D_{OT} and the thickness g_{OT} and as the object to be processed a railroad track with finite length L (Fig.2). Taking into account the dimensions of the object to be processed and also using a technological process for cutting, the processing can be made this way:

object to be processed – transfer object in radial forward flow motion for processing

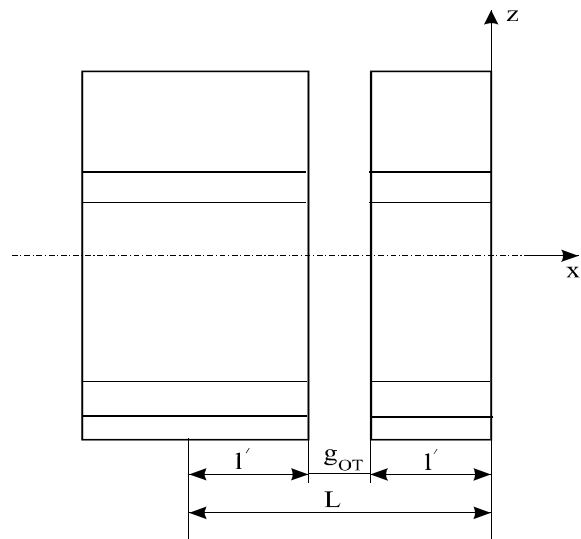


Fig. 2 Diagrammatic representation of the object to be processed – railroad track with a finite length

According to the relation (1), the studied zone (with the finite length of $2l'$) it is composed of the thermal influenced section of the object to be processed, which lies on the both sides of the section that needs to be processed (l'), and also composed of the corresponding finite element, his volume is decreasing simultaneously with the sampling of the matter

$$L = 2l' + g'_{OT} \quad (1)$$

The thickness g'_{OT} it is composed of the thickness of the transfer object (g_{OT}) and the height h' of the material removed from the object to be processed as a result of the actions of the side surfaces of the transfer object :

$$g'_{OT} = g_{OT} + 2h' \quad (2)$$

This thickness is equivalent to the height g'_{OT} of the section of material removed from the object to be processed.

4. THE PROPAGATION OF THE THERMIC FIELD WHEN CUTTING THE RAILROAD TRACKS

We analyze the steps of propagation in the thermic field, for the fix object to be processed – transfer object a disk with radial forward flow for processing alternative, beginning with general issues.

The transfer object has a forward flow motion for processing and is perpendicular on the longitudinal axis of the object to be processed, comes into contact with the exterior surfaces of the object to be processed in the point M, in the initial moment τ_0 of processing. The progress s_t is calculated after the Oz axis of the object to be processed (h_{OP}) so that the contact point M has a linear trajectory along this axis in the

final moment of processing (cutting), until the end of the forward flow motion.

Point M belongs/is a part of the processing active surface S_a , for keeping this step of the case study simple we do not take the surface into consideration, only the point M.

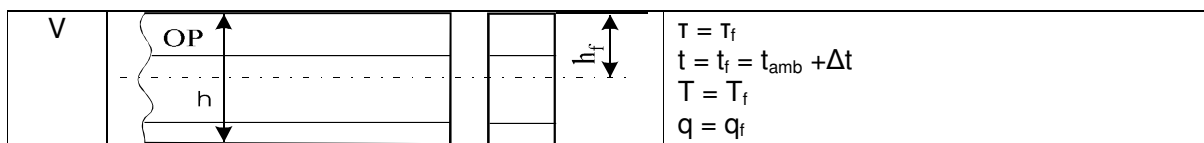
He movement of this point takes place in the same time with the propagation of the thermic field, in a radial direction and also after O_x and O_y axis according to the representation from Table 1, where q is the density of the thermic flux, T is the scalar thermic field, T is the time and t is the temperature.

If we analyze the representation in the Table 1, we can give a definition of the thermic field for this case and that would be drop style.

Complex erosion processing with a fixed object to be processed and a transfer object in radial forward flow motion for processing is used in the case of blanks/semi-finished materials with small diameters, where the section of the object to be processed it considerably smaller than the one of the transfer object.

Table 1. The steps of thermal field propagation for the case object to be processed railroad track – transfer object a disk in radial forward flow motion for processing

Stage	Graphique représentation	Characteristics
I		$T = T_0 = 0$ $h_0 = 0$ $t = t_0 = t_{amb}$ $T = T_0$ $q = q_0$
II		$T = T_1$ $t = t_1 = t_{prel}$ $T = T_1$ $q = q_1$
III		$T = T_i$ $t = t_i = t_{prel}$ $T = T_i$ $q = q_i = q_{max}$
IV		$T = T_{f-1}$ $t = t_{f-1} = t_{prel}$ $T = T_{f-1}$ $q = q_{f-1}$



5. CONCLUSIONS

The study of the thermic field in the case of complex erosion processing of the railroad tracks completes the studies made in this area of research, on one hand for complex erosion processing and on the other hand for finding new technological methods to ensure a higher productivity for the process of cutting the railroad tracks.

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