Секция: Физико-математические науки

Fialko Nataliia

Doctor of Technical Sciences, Professor,

Corresponding Member of NAS of Ukraine, Department Head

Institute of Engineering Thermophysics of

National Academy of Sciences of Ukraine

Kyiv, Ukraine

Prokopov Viktor

Doctor of Technical Sciences, Professor, Leading Researcher

Institute of Engineering Thermophysics of

National Academy of Sciences of Ukraine

Kyiv, Ukraine

Sherenkovskiy Julii

Candidate of Technical Sciences (PhD),

Senior Scientific Researcher, Leading Researcher

Institute of Engineering Thermophysics of

National Academy of Sciences of Ukraine

Kyiv, Ukraine

Yurchuk Volodymir

Candidate of Technical Sciences (PhD), Senior Researcher

Institute of Engineering Thermophysics of

National Academy of Sciences of Ukraine

Kyiv, Ukraine

Kutnyak Olha

Researcher

Institute of Engineering Thermophysics of

National Academy of Sciences of Ukraine

Kyiv, Ukraine

USE OF POLYARGUMENT SYSTEMS METHODS FOR DETERMINATION OF BOUNDARY VALUES OF PARAMETERS OF LASER HARDENING

The work is devoted to the study of regularities of transition from favorable to unacceptable conditions of the cutting tool hardening with a laser beam.

One of the negative situations in the practice of the tool hardening consist of with the melting of its cutting edge was considered.

For this situation, a certain limiting case is indicated, delimiting the areas of permissible and unacceptable values of the technological parameters of the hardening process. It is necessary to determine the specified limit (threshold) values of the parameters.

The study is based on solving a volumetric quasi stationary heat transfer task for a wedge-shaped area. In this case, hardening occurs due to the impact on a material of a normally distributed laser heating source moving at a constant speed. The problems of heat transfer in this cutting tool are solved using the methods of polyargument systems, the main provisions of which are given in [1-5].

For the situation under consideration, the effect of the distance between the cutting edge and the center of the laser beam a * on the threshold values of the velocity of movement of the beam is determined. The extreme dependence of the dimensionless boundary velocity Pe of the laser beam on the distance a * is established. An explanation of the interdependence of these parameters based on an analysis of the action of a number of competing factors is given.

In work options of various sizes of an angle of sharpening of the tool are considered. An inversely proportional dependence of the threshold value of the dimensionless velocity on the wedge sharpening angle, all other conditions being equal, is revealed.

The obtained boundary values of the parameters should be the basis for the design of technological modes of hardening the cutting tool with a laser beam.

References

1. Prokopov V.G. Application of methods of complete polyargument systems for solving nonlinear multidimensional problems of heat transfer / V.G. Prokopov, E.I. Bespalova, Ju.V. Sherenkovskiy // University news. Power industry. 1986. V. 33. P.84-89.

2. Prokopov V.G. Fundamentals of the theory of localization / V.G. Prokopov, N.M. Fialko, Ju.V. Sherenkovskiy. Kyiv: Institute of Engineering Thermophysics, NAS of Ukraine, 2003. 200 p.

3. Prokopov V.G. Increasing the efficiency of modeling multidimensional heat transfer processes based on the methods of polyargument systems and localization theory / V.G. Prokopov // Author's abstract. dis ... doc.techn.sien. Kyiv: NTUU "KPI", 2010. 44 p.

4. Fialko N.M. Investigation of heat transfer processes during surface mounting of microprocessors of integrated circuits / N.M. Fialko, V.G. Prokopov, V.G. Saryoglo et al. // Reports of the Academy of Sciences of the USSR. 1991. N. 1. P. 59-64.

5. Prokopov V.G. On the problem of transformation of independent variables in low-mode modeling of multidimensional heat and mass transfer processes / V.G. Prokopov, D.G. Blinov, Ju.V. Sherenkovskiy et al. // Problems of industrial heat engineering: proceedings IV Int. conf. Kyiv, 2005. P. 295-296.