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# Definition of titanium EDM pulse parameters based on solution of the Stefan heat problem

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*The article presents the results of theoretical studies of titanium machinability by electrical discharge machining (EDM), based on the solution of the Stefan heat problem. We propose a method for determining the parameters of titanium electrical discharge machining pulses and give recommendations for their intended purpose. Moreover, we define the minimum heat flux density and its duration, necessary to implement the titanium EDM process. We established the dependence of the minimum values of heat flux pulse duration at which the titanium electrical discharge machining is carried out, on the density of the heat flux. We determined the maximum values of pulse durations of heat fluxes acting on the titanium to ensure the maximum material removal per pulse, and the effective durations of the heat fluxes, providing the maximum performance of titanium EDM process, as appropriate for the heat flux density.*

**Keywords:** EDM, EDM pulse parameters, titanium machinability, heat flux density, electrical pulses duration

## REFERENCES

- [1] Eliseev Yu.S., Saushkin B.P. *Elektroerozionnaya obrabotka izdeliy aviatsionno-kosmicheskoy tekhniki* [Aerospace equipment EDM]. Moscow, BMSTU Publ., 2010.
  - [2] Zolotykh B.N., Lyubchenko B.M. *Inzhenernaya metodika rascheta tekhnologicheskikh parametrov EEO* [Engineering method of calculating EDM technological parameters]. Moscow, Mashinostroenie Publ., 1981.
  - [3] Dhirendranathmishra, Aarti Bhatia, Vaibhav rana. Study on Electro Discharge Machining (Edm). *The International Journal of Engineering and Science (IJES)*, 2014, vol. 3, pp. 24–35.
  - [4] Ms. Sharanya S. Nair Int. Trends in Wire Electrical Discharge Machining (WEDM): A Review. *Journal of Engineering Research and Applications*, 2014, vol. 4, pp. 71–76.
  - [5] Chandramouli S., ShrinivasBalraj U., Eswaraiah K. Optimization of Electrical Discharge Machining Process Parameters Using Taguchi Method. *International Journal of Advanced Mechanical Engineering*, 2014, vol. 4, no. 4, pp. 425–434.
  - [6] Zolotykh B.N. *Osnovnye voprosy teorii elektricheskoy erozii v impulsnom razryade v zhidkoy dielektricheskoy srede*. Diss. dokt. tekhn. nauk [Main problems of electrical erosion theory in pulsed discharge in liquid dielectric medium. Dr. eng. sc. diss.]. Moscow, 1967.
  - [7] Kreith F., Black W.Z. *Basic Heat Transfer*. Harper and Row Publ., New York 1980 [In Russ.: Kreit F., Blek U. *Osnovy teploperedachi* [Heat transfer fundamentals]. Moscow, Mir Publ., 1983].
  - [8] Stavitskiy I.B. *Vestnik MGTU im. N.E. Baumana, spets. vypusk "Energeticheskoe i transportnoe mashinostroenie"* — *Herald of the Bauman Moscow State Technical University. Spec. iss. "Power and Transport Engineering"*, 2011, pp. 164–171.
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- [9] Stavitskiy I.B., Khapaev M.M. *Vestnik MGTU im. N.E. Baumana. Ser. Mashinostroenie — Herald of the Bauman Moscow State Technical University. Ser. Mechanical Engineering*, 1997, no. 2, pp. 95–100.
- [10] Okulov N.A. *Vychislitelnye metody i programmirovaniye — Numerical Methods and Programming*, 2011, vol. 12, pp. 238–246.
- [11] Kalitkin N.N., Koryakin P.V. Chislennyye metody [Numerical methods]. *Metody matematicheskoi fiziki* [Methods of mathematical physics]. Book 2. Moscow, Akademiya Publ., 2013.
- [12] Gupta S.C. The Classical Stefan Problem: basic concepts, modelling and analysis. *North-Holland Series in Applied Mathematics and Mechanics*. JAI Press, 2003.

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