Method for Determining of the Anti-adhesion Ability of Cutting Fluids

Andrey Dugin, Jan Jersak, Alexey Popov
Department of Machining and Assembly, Faculty of Mechanical Engineering, Technical University of Liberec.
461 17, Studentská 1402/2, Liberec 1, Czech Republic. E-mail: andrey.dugin@seznam.cz, jan.jersak@tul.cz, alespopov@yandex.com.

In most cases, the use of cutting fluids increases machining productivity while cutting different types of materials. Anti-adhesion ability is one of the main properties of cutting fluids increasing the tool life. Companies producing cutting fluids need to acquire information on anti-adhesion abilities of the cutting fluids as well as on anti-adhesion abilities of individual substances and effects for future development of their products. Consequently, methodology for evaluating anti-adhesion ability of cutting fluids was designed. The substance of the method consists in the evaluation of differences in the size of the wear area created under otherwise identical cutting conditions while using different cutting fluids at the front surface of the cutting tool where adhesive wear occurs during the cutting process under certain cutting conditions. The methodology was verified using 11 process fluids.

Keywords: Machining, Cutting fluid, Adhesion, Wear

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References

[1] KLOCKE, F., EISENBLATTER, G., (1997), Dry Cutting, *Annals of the CIRP*, 46(2), pp. 519-526

[2] JAYAL, A. D., BALAJI, A. K., (2009), Effects of cutting fluid application on tool wear in machining: Interactions with tool-coatings and tool surface features, *Wear*, 267(9-10), pp. 1723–1730

[3] KHAN, M., M., A., MITHU, M., A., H., DHAR, (2009), Effects of minimum quantity lubrication on turning AISI 9310 alloy steel using vegetable oil-based cutting fluid*, Journal of Materials Processing Technology*, 209(15-16), pp. 5573–5583

[4] THEPSONTHIA, T., HAMDI, M., MITSUI, K., (2009), Investigation into minimal-cutting-fluid application in high-speed milling of hardened steel using carbide mills*, International Journal of Machine Tools and Manufacture*, 49(2), pp. 156–162

[5] NOVAK, M., DOLEZAL, R., (2012), G-Ratio in hardened steel grinding with different coolants*, Manufacturing Technology*,12(13)

[6] POPOV, A., DUGIN, A., (2013), A comparison of experimental estimation methods of the ploughing force in ortho-gonal cutting*, International Journal of Machine Tools and Manufacture*, 65, pp.37–40

[7] DUGIN, A., POPOV, A., (2013), Increasing the accuracy of the effect of processing materials and cutting tool wear on the ploughing force values, *Manufacturing Technology*, 13(2), pp. 169 – 173.

[8] DUGIN, A., POPOV, A., 2012, Effect of the processing materials on the ploughing force values*, Manufacturing Tech-nology*, 12(13): 169-173

[9] POPOV A, DUGIN A, (2013) Influence of Lubricant and Coolant Fluid on the Cutting Force in Small-Increment Pla-ning, *Russian Engineering Research*, 33(2):84-85

[10] VASILKO, K., MURČINKOVÁ, Z., (2013), Analysis of geometric accuracy of turned workpieces, *Manufacturing Technology*, 13(2), pp. 247-252

[11] NÁPRSTKOVÁ, N. , SVOBODOVÁ, J., CAIS, J., (2013), Influence of strontium in AlSi7Mg0.3 alloy on the tool wear, *Manufacturing Technology*, 13(3), pp. 368-373.

[12] POPOV, A., DUGIN, A., (2013), Study of reasons of increased active force using coolant with uncut chip thickness, *The International Journal of Advanced Manufacturing Technology*, October, pp.1-8.

[13] POPOV A, DUGIN A, (2013) Influence of Lubricant and Coolant Fluid on the Cutting Force in Small-Increment Plan-ing, *Russian Engineering Research*, 33(2), pp. 84-85

[14] ARMAREGO, E. J., BROWN, R., H., (1969) ,*The Machining of Metals*, Prentice-Hall

[15] TRENT, E.M., MET, D., (1977), *Metal Cutting*, Butterworths

[16] ZOREV, N., (1966) Metal cutting mechanics, *Pergamon Press*, Oxford, 135-180

[17] LOLADZE, T.N., (1981), Of the Theory of Diffusion, *CIRP Annals - Manufacturing Technology*, Volume 30(1):71-76

[18] NAVES, V.T.G., DA SILVA, M.B., DA SILVA, F.J., (2013), Evaluation of the effect of application of cutting fluid at high pressure on tool wear during turning operation of AISI 316 austenitic stainless steel, *Wear*, 302(1-2), pp. 1201–1208

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