

EXPERIMENTAL STUDY ON RUL1V BEARING STEEL HARDNESS, RAKE ANGLE AND TOOL MATERIAL INFLUENCE ON CUTTING FORCES

STANIMIR Alexandru, COPILUȘ Petre Cristian, ZAMFIRACHE Marius

University of Craiova
alexstanimir@yahoo.com,

Keywords: hardness, orthogonal cutting, rake angle, cutting forces, friction coefficient

Abstract: In this study, in order to analyze the cutting forces components F_p and F_c variation in the machining of RUL 1V bearing steel at different hardness (215, 350 and 720 HV), resulted after appropriate heat treatments, orthogonal cutting tests were carried out at various values of rake angle ($\gamma=-6^\circ$ and -28°). Also, using new and worn tools in different materials as HSS, carbides, ceramics and PCBN, the friction coefficient on the wear flank was calculated. The results of the experiments show that, both, workpiece hardness and rake angle, influence the thrust force component F_p , the cutting force component F_c , the result force R and the rapport F_p/F_c . The maxim friction coefficient value $\mu_m=0,85$, was obtained for the combination RUL1V(215HV)/HSS and the minim value $\mu_m=0,12$, was obtained for the combination RUL1V(720HV)/PCBN.

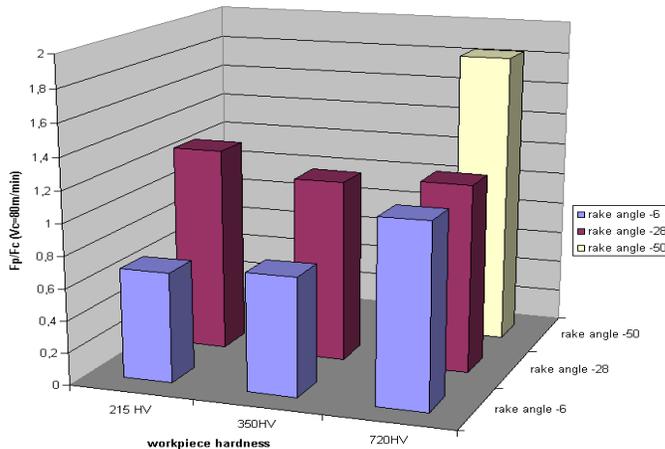


Fig.1. The workpiece hardness and rake angle influence on F_p/F_c

$a_1=0,1mm$; $b_1=0,5mm$; $V_c=80m/min$; no coolant

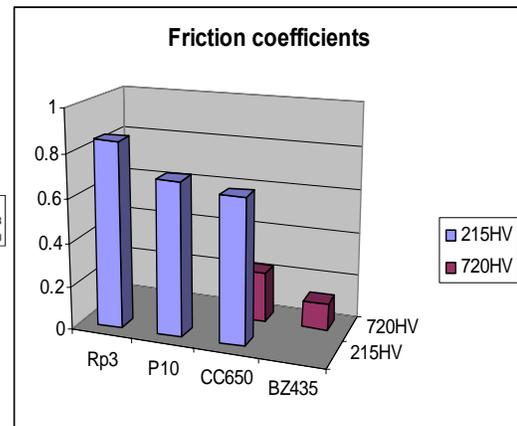


Fig. 2. Friction coefficient on flank face for different tool materials and workpiece hardness

CONCLUSIONS

The experimental results presented in this paper show that the variation of force components depends on the workpiece hardness, the rake angle negative values and the combining mode of these parameters. The machining of hardened steel is characterized by small values of friction coefficients on the flank face, which can explain a smaller increase of cutting force component F_c , comparative to thrust force component F_p , with the flank wear.

REFERENCES

- [3]. König. W., Berkold. A., Koch. K-F., - *Turning versus grinding – A Comparison of Surface Integrity Aspects and Attainable Accuracies*, CIRP, 42/1/1993, p 39-43;
- [4]. Nakayama. K., Arai. M., Kanda. T., *Machining Characteristics of Hard Materials*, CIRP, 37/1/1988, p89-92;
- [7]. Thiele. J.D., Melkote. S.N., - *Effect of cutting- e geometry and workpiece hardness on surface residual stresses in finish hard turning of AISI 52100 steel*, J. Mater. Process Technol., 94/1999, p 216-226;