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THE PLOUGHING EFFECT AT DRILLING OF THEIR INFLUENCE ON THE PRODUCTION OF HOLES

Abstract:
Automated production has characteristic features: a reduction of production costs, stimulation of the development of cutting tools, and changes in the construction of machine tools, all of which work against the creation of optimal technological methods, which thrusts the technological process of cutting into a more important position. These trends confirm that the cutting process remains one of the basic manufacturing technologies. This article presents the results of experiments that concerned the verification of tool wear and special "Ploughing effect" on the cutting tool of workpieces of difference types of austenitic stainless steel. The paper present of real experimental results. The authors would like to thank in words the KEGA grant agency at the Ministry of Education SR for supporting research work and co-financing the projects: Grant work KEGA #3/7166/2009

Keywords:
tool wear, cutting zone, cutting tool, drilling

INTRODUCTION

The cutting proces is interaction between cutting tool and workpiece. Every material has a internal energy, which in cutting proces change. This is energy has the main influence on the results by drilling. On the start is defined internal energy E_t of cutting tool, the next is defined internal energy of workpiece E_w. The themodynamical phenomenas is orientated on the problems of research of tensions on the tool figure 1 and definition the motion energy between interaction two materials influence. The result is equations

$$E_w + E_t \Rightarrow surface\,conditions(quality, precision, tension) \quad (1)$$

$$E_w = function(microstructure, chemical\,condition) \quad (2)$$

$$E_t = function(microstructure, chemical\,condition, hardness) \quad (3)$$

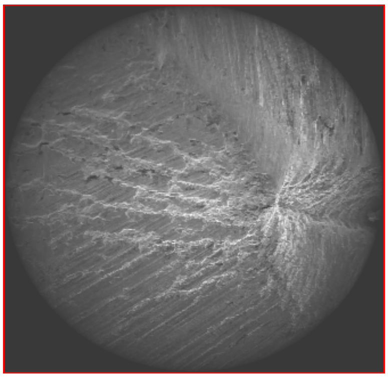


Fig.1 Tension place on the cutting tool - clearance area, mag.100x

DEFORMATION IN CUTTING ZONE

Stainless steel they have individual requirements, but require reach at it, that can a few brand stainless steel, between that requirements about metal cutting differ. Applied *modern special implements enable reduce generality problems, connect with machining present band material, alternatively these mess enable absolutely cast out about their true app. Austenitic stainless steel are one from the main tip of stainless steels, that applied because machining fabrication component. Be due broad appliance and machined chiefly turning and drilling. Bases requirements about cutting tool because metal cutting of stainless steel in compare with another alloy steel are, [2], [3] [4], [8]:*

- *advanced addiction at built up edge (BUE)*
- *drift at hardening of material.*

These requirements we can chiefly eliminate true alternative inserts, videlicet band (ISO-M), that recommends generality world machinist of cutting tools. Action machining of stainless steel is dearly many a time accompanying birth BUE on the cutting edge, that make bucking tool life (currency) of cutting tool, affects brand of machined surfaces, give out at alteration dynamic characteristic of cutting process (cutting forces, cutting resistance,…), come-down action chip formation, as well as affect about assurance machining. In machining operations, mechanical work is converted to heat through the plastic deformation involved in chip formation and through friction between the tool and the workpiece, [1], [5] [6], [7]:

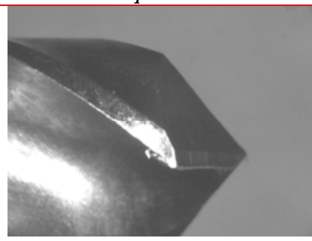
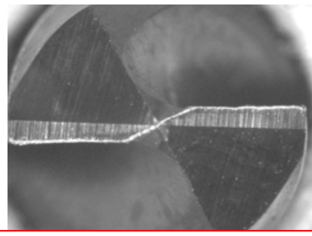
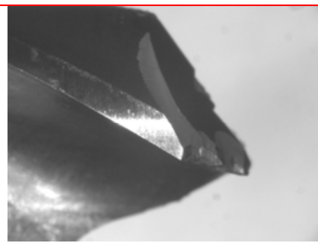
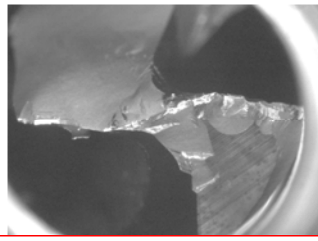
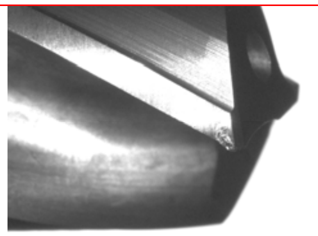
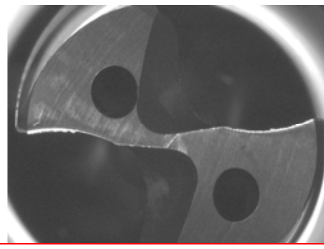
EXPERIMENTAL PART

Drilling tests were carried out using a vertical machining centre equipped with 10 000 rpm, 16 kW spindle. The tests used and HW-M20 drills with a diameter of Ø 10 mm, at a cutting speed of 40 m/min and feed of 0,1 mm/rev were used without coolant. All experiments was realizated in practice by production product from X6Cr16Ni9Mn steel. In the tests used HW-M20 by conditions - cutting speed preliminary 25 m/min, presented in figure 2. Characteristical tool wear for different cutting conditions show is table 1.

About machining of stainless steel needed adhere following commendation, that are results experimental measured at laboratory and applied clause, [9], [10], [11], [12], [13], [14:

- *needed act machining material attest*
- *apply inserts ISO-M*
- *secure consistence system machine-tool-workpiece-fixture*
- *technological discipline maint manufactural engine*
- *cutting tool exchange already about knock-down number of cutting edge*
- *cutting tools cast a voice by your leave capacity conjuction because surety adequate consistence and efficacious conscription warm of cutting tool*

Tab.1 Tool wear at the cutting part

Type of the cutting material	*Tool wear at the cutting part*
HSS	 
HW-M20	 
HW-JET	 

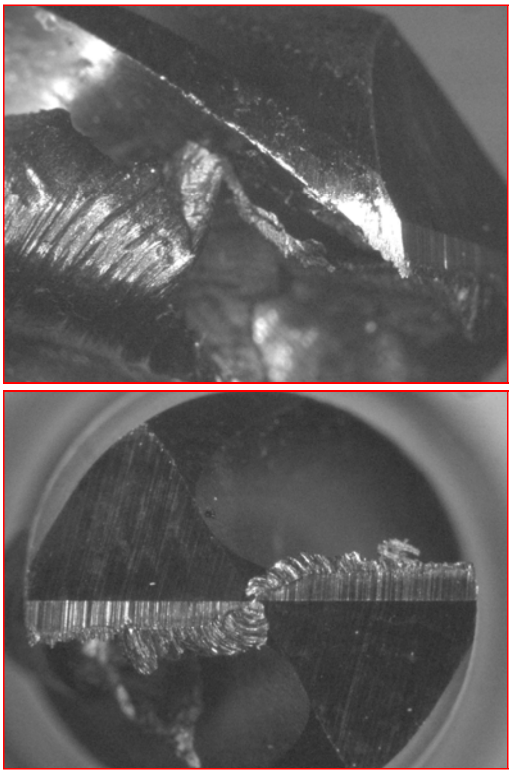


Fig.2 The drill used in cutting tests. The formation of built-up edge (BUE) is present, HSS

In the course of material selection, the cutting process generally can arise from the traits which the work piece material and the conditions of the cutting process. This character is material machinability. According to Cook material machinability is a quality of the material that expresses its capacity to process the work piece from the point of view of its functional qualities. Creation and formation of chips and tool wear of the cutting edge of the instrument influence the capacity of work piece processing. According to Tipnis material machinability is expressed as a quality of the material, which is defined by the state of the cut surface, the creation and shaping of chips, the effect of cutting forces and the durability of the cutting edge. According to Loladze, material machinabi-lity is a quality of the object material, which expresses its qualitative state by yielding to the effect of the cutting wedge. According to Victor, material machinability is a concept expressed by impermanence, change, and one with many possible meanings. According to the authors of this article, work piece material machinability is a quality of the work piece material that is defined in each individual case by the precise method of the cutting process, and the conditions of the technological system of instrument-object-setup. According to Mikovec a collec-tion of hard-to-machine materials comprises: construction steel selected for high strength and firmness, tempered austenitic manganitic stainless steel, nonmagnetic nickel-manganese and chrome-manganese steels, stainless and high-alloyed chrome steels, austenitic stainless steels, refractory and heat-treated, hardened chrome-nickel steels, nickel and cobalt alloys, highly-smeltable metals and several further types of powder-metallurgy productions. Sintered carbide instruments are preferable in a cutting instrument, according to the author's recommendations. Mikovec recommends values for the dimensions of cutting instruments. In turning austenitic stainless steels, it is not recommended a negative facing angle be chosen, because it causes strain hardening along the cutting surface, and because it produces constant chips, so a cutting lathe can be used instead, with chip shapers. According to the author the choice of cutting conditions depends on the type, shape, size (thickness and firmness) of the cutting instrument, and the type, size (thickness), and capacity of the turning machine, and most of all of the material of the cutting portion of the instrument, the required life of the cutting wedge, and the material of the work piece. For austenitic stainless steels, which are characterized by strain hardening of the surface during the cut, it is recommended that the thickness of chip h_1 be larger than 0.1 mm. The cutting zone is a summary term from the region during cutting To properly describe the cutting zone it is necessary to describe the regions and test parameters. Primary plastic deformation zone (primarily an examination of phenomena associated with the creation and formation of chips, with the effect of the components of cutting force-the state of strain deformation, the location of the angle of the shear level, chip compression, the temperature field, chip shape, chip formation and separation, the effect of the components of cutting force)

Secondary plastic deformation zone (primarily an examination of phenomena associated with friction and cutting wedge wear, and also with the generation of heat and temperature-the location of the grain angle, the contact length of the cutting wedge and the face plate, friction stress and scab creation (BUE), friction, the generation of heat and temperature, the mechanism of tool wear). Tertiary plastic *deformation zone (primarily an examination of the phenomena associated with the shaping creation of the machined surface, its profile, morphology, qualities and inherited traits-contact of the machined surface and the worn side plate). Cutting surface, its properties and integrity. The gradually-deformed region of the cut layer.*

CONCLUSION

Tool wear monitoring is economically very important but technically a rather demanding task. In this paper an attempt has been made in order to reach further understanding of the dynamics that influence the drilling process and especially what happens when a drill is worn. A very simplified approach has been tested in the development of the cutting forces and modeling the influence of wear in these forces. Such factors as geometrical difference of the cutting lips, different kind of wear history of the lips, vibration at first natural frequency and excitation at harmonics of the speed of rotation have been taken into account in the development of the excitation force. The developed forces have been used for excitation of a simplified one degree of freedom model of the drill. The dynamic model has been used for producing vibration velocity signal as a function of drill wear and with this signal the most typical and widely used signal analysis techniques i.e. statistical time domain parameters and spectrum analysis have been tested.

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