OPTIMISATION OF INSERTS' GEOMETRY AND CUTTING PARAMETERS FOR PLASTIC TURNINGS

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ABSTRACT: Each plastic requires a different geometry for optimum performance and good productivity. In the cutting process, plastics are characterized by the fact that the chips stick again after cutting the workpiece or cutting tool. Tool geometry must be designed to exit the chips away from the cut, not only to resolve this problem, but to protect the finishing. Also, the success of plastic turning processes depends on the degree of fragmentation of chips. Therefore, this study deals with the geometry of the inserts and the correct choice of cutting data to optimize the turning plastic process.

KEY WORDS: Plastic turnings, Tool geometry.

1 GENERALITIES

Cutting process occupies a significant share in overall manufacturing methods. For this reason, the research on optimisation of machining cutting requires a continuous development.

Optimum values of cutting parameters must be obtained in relation to the technical and economic requirements without imposing general conditions for the cutting process.

Thus, knowing the values of cutting parameters is a necessary condition for the stability of the cutting process, productivity, precision processing tools and power consume to obtain the final nominal values.

In this regard it is necessary to study the influence of each parameter on the criteria which allows subsequently an ordering of the influences of processed parameters on the criteria.

This paper aims to study the behavior of an epoxy resin type of material on turning. The studied material is a L285 epoxy resin. The resin is used at the production of gliders, motor gliders and motor planes, boat and shipbuilding, sport equipment, model airplanes, moulds, tools and others.

Epoxy resin type material loses heat more slowly than metals, so the cutting process is necessary to avoid overheating in the cutting area because the melting point is much lower than the cutting metals' one. Because of these differences, the cutting of plastics has some features, both from the point of view of the cutting tool geometry and from the point of view of the cutting regime.

Figure 1. **Epoxy resin type of material**

When cutting plastic materials, the main problems are the deposition of material on the cutting tool and the chip fragmentation.

Due to the external force, it occurs a phenomenon of adhesive by pressing the parts of the workpiece on the rake face of the tool. This phenomenon occurs when the ties are strong, ruptures occurring in chip mass.

The deposition of the final material is increased and, finaly, it will be removed by the material flow. The speed of the current is higher, so the removal of the deposition is faster. The destruction of the deposit on the edge of the material particles is removed from the tool.

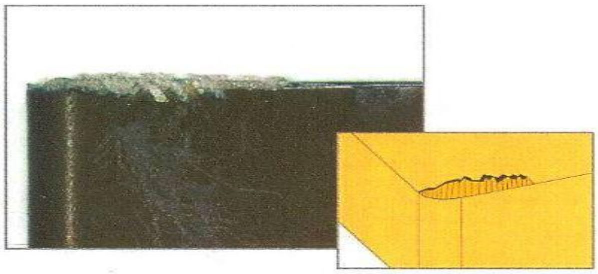

Figure 2. **Wear due to deposits on the edge**

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2 THE EXPERIMENTAL STUDY

The type of the insert cutting tool is SUMITOMO CNMG 120408N-MU AC830P.

AC830P inserts are used for a wide range of applications, being used both for mass production and for small series. Such inserts are characterized by a special coating and by a special control chip evacuation due to special geometries.

To study the behavior of epoxy resin the processing feed and the cutting speed were modified, while maintaining constant depth of processing.

Within the study we used five cutting data. For the first regime it was used a cutting speed: v_1 = 31,4 m/min, a processing feed: f_1 = 0.2 mm / min, and the depth of processing: a_p = 0.5 mm.

Figure 3. The SUMITOMO inserts (cutting tool)

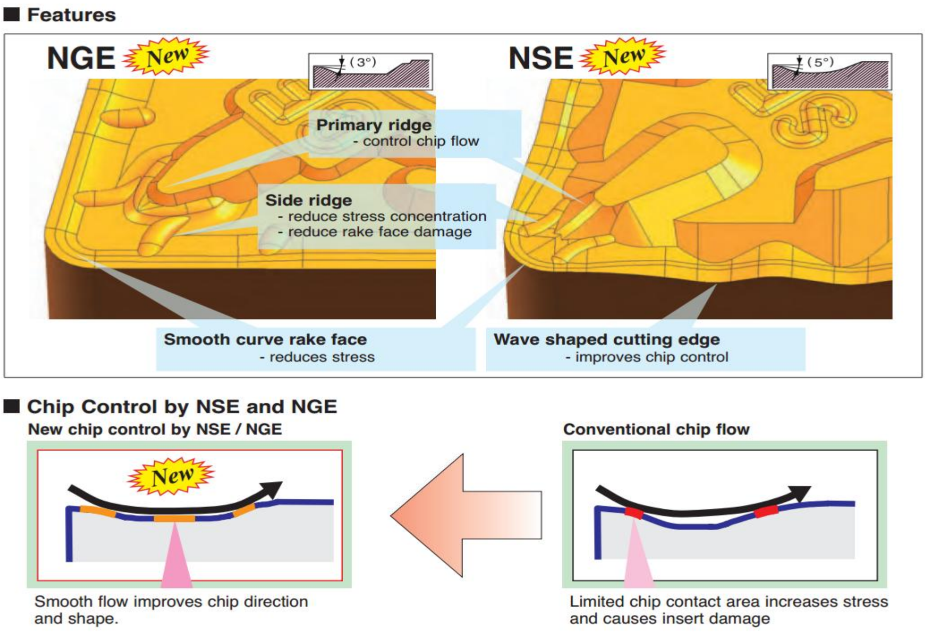

Figure 4. Special geometries and special control of chip evacuation

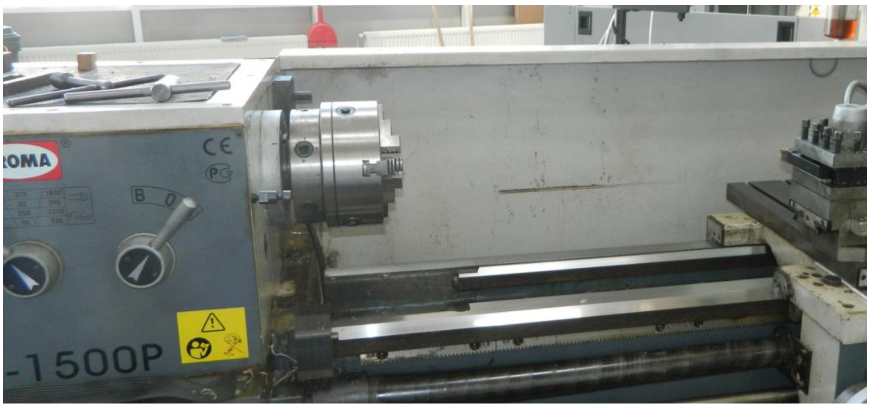

Figure 5. The normal turning on a lathe

For the second regime it was used a cutting speed: v_1 = 48,6 m/min, a processing feed: f_1 = 0.24 mm/min, and the depth of processing: a_p = 0.5 mm.

For the third regime it was used a cutting speed: v_1 = 68,9 m/min, a processing feed: f_1 = 0.35 mm/min, and the depth of processing: a_p = 0.5 mm.

In the context of the fourth cutting regime it was used a cutting speed: v_1 = 85,3 m/min, a processing feed: f_1 = 0.4 mm/min, and the depth of processing: a_p = 0.5 mm.

For the last regime it was used a cutting speed: v_1 = 104,2 m/min, a processing feed: f_1 = 0.5 mm / min, and the depth of processing: a_p = 0.5 mm.

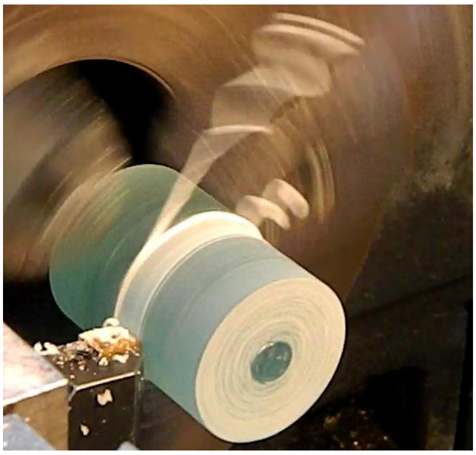

Figure 6. The chip fragmentation in the first cutting regime

Figure 7. Material deposition in the first cutting regime

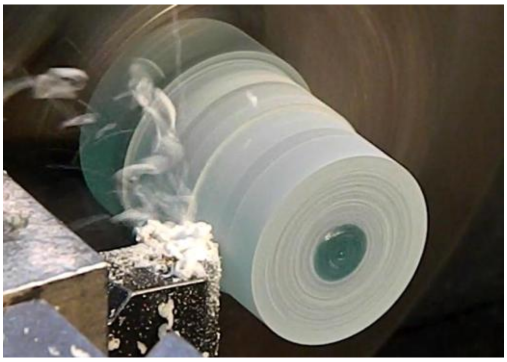

Figure 8. The chip fragmentation in the second cutting regime

Figure 9. The chip fragmentation in the third cutting regime

Figure 10. The chip fragmentation in the fourth cutting regime

Figure 11. The chip fragmentation in the context of the fifth cutting regime

Figure 12. The material deposition after the last cutting regime

3 CONCLUSIONS

The conclusions of this experiment are:

Use of a small cutting speed favors the long-chipping, their fragmentation being achieved with difficulty;

With increasing cutting speed and feed, the material deposition on the edges is reduced, and chips' fragmentation is more easily obtained;

The fragmentation of chips begins to be convenient when using a speed over 60 m/min; The material deposition values on the cutting tool edge are considerably lower;

The use of positive geometries with special striations helps chip fragmentation in good conditions.

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