8TH WORKSHOP ON SURFACE ENGINEERING

02.06.2019 to 08.06.2019, Koszalin University of Technology, Poland

COMPARSION OF TOOL WEAR ON THE SELECTET INSERTS

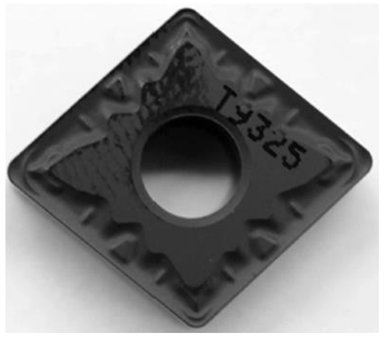
Šramhauser, K., Náprstková, N., Faculty of Mechanical Engineering, Jan Evangelista Purkyně University in Ústí nad labem, Czech Republic

SUMMARY

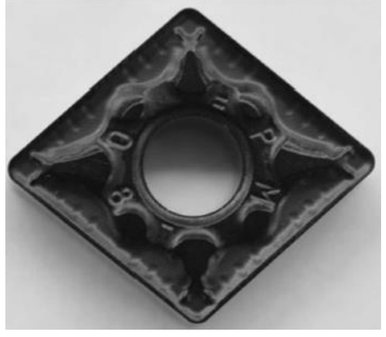
The process of measuring cutting inserts wear allows to optimize the machining process in accordance with the specified cutting conditions and depending on the used machined material. Cutting inserts wear research is realized at the Faculty of Mechanical Engineering of Jan Evangelista Purkyně University in Ústí nad Labem. Part of this research is to monitor wear development on selected turning inserts that are used on different types of materials under the same cutting conditions.

EXPERIMENT

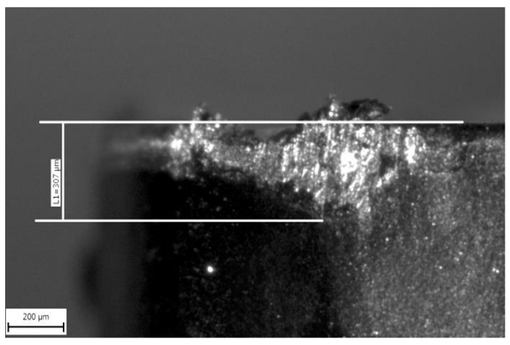
As an experimental material was turned stainless steel class 1.4404 (0,2 wt. % Mn, 16,5 ÷ 18,5 wt. % Cr, 11 ÷ 14 wt. % Ni, etc.) according to DIN EN 10088-3. This is corrosion-resistant steel in an industrial environment, particularly resistant to pitting corrosion in the presence of chlorides, and especially resistant to sulfuric acid and phosphoric acid. Steel class 1.4404 is weldable without the risk of intergranular corrosion in the area of thermal influence. It is suitable for cold forming and has good workability. Material was turned on the three-axis CNC lathe DOOSAN Lynx 220L with the control system FANUC. For all operations was used tool holder PCLNR 2020 K12. The depth of cut ap was set at 1.5 mm because the system had an instability at depth of 2 mm offset. Feed rate f was set to 0,3 mm.ot-1. The inserts were tested at cutting speeds vc = 80 m.min-1, 100 m.min-1, 120 m.min-1 and 140 m.min-1. The critical wear limit of VBMAX was determined on 0,3 mm. Measurements were made on two rhomboidal-shaped removable turning inserts, namely on CNMG 120408E-FM, T9325 by Pramet and CNMG 120408-PM, 4325 by Sandvik. For measurement was used Olympus SZX10 stereomicroscope with measuring software in parallel. Along with the measurement of VBMAX flank wear, the shape and the length of chips was continuously analyzed using the cut-off method. cut-off method was performed on the Olympus SZX10 stereomicroscope. From each sample taken after the cutting cycles, 10 chips were selected that were most present in the sample set (type of shape). Chips were evaluated by ISO 3685



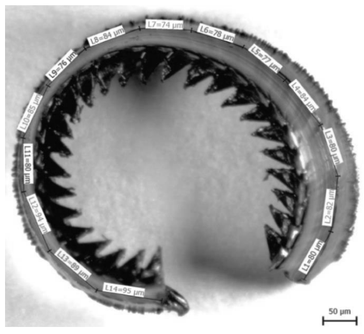
Pramet CNMG 120408E-FM, T9325



Sandvik CNMG 120408-PM, 4325



Measurement of turning insert‘s VBMAX wear values illustration



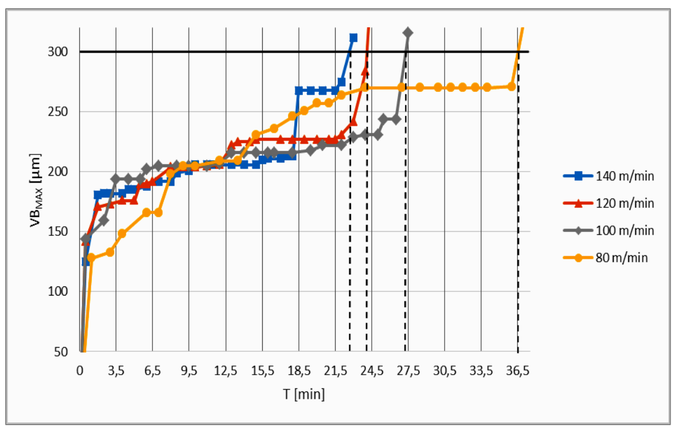
Principle of chip leght measurement by cut-off method

RESULTS AND DISCUSSION

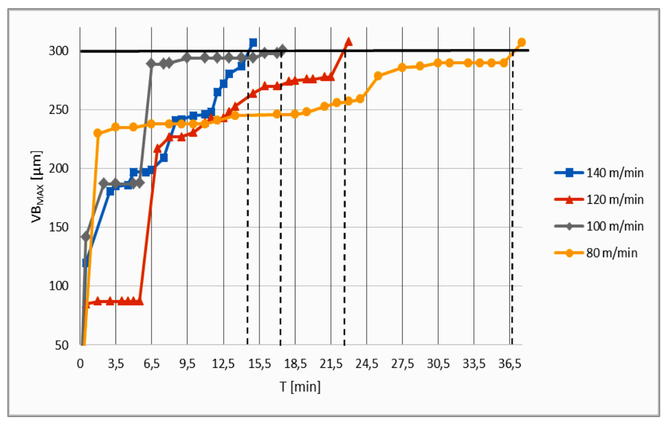
As an experimental material was turned stainless steel class 1.4404 (0,2 wt. % Mn, 16,5 ÷ 18,5 wt. % Cr, 11 ÷ 14 wt. % Ni, etc.) according to DIN EN 10088-3. This is corrosion-resistant steel in an industrial environment, particularly resistant to pitting corrosion in the presence of chlorides, and especially resistant to sulfuric acid and phosphoric acid. Steel class 1.4404 is weldable without the risk of intergranular corrosion in the area of thermal influence. It is suitable for cold forming and has good workability. Material was turned on the three-axis CNC lathe DOOSAN Lynx 220L with the control system FANUC. For all operations was used tool holder PCLNR 2020 K12. The depth of cut ap was set at 1.5 mm because the system had an instability at depth of 2 mm offset. Feed rate f was set to 0,3 mm.ot-1. The inserts were tested at cutting speeds vc = 80 m.min-1, 100 m.min-1, 120 m.min-1 and 140 m.min-1. The critical wear limit of VBMAX was determined on 0,3 mm. Measurements were made on two rhomboidal-shaped removable turning inserts, namely on CNMG 120408E-FM, T9325 by Pramet and CNMG 120408-PM, 4325 by Sandvik. For measurement was used Olympus SZX10 stereomicroscope with measuring software in parallel. Along with the measurement of VBMAX flank wear, the shape and the length of chips was continuously analyzed using the cut-off method. cut-off method was performed on the Olympus SZX10 stereomicroscope. From each sample taken after the cutting cycles, 10 chips were selected that were most present in the sample set (type of shape). Chips were evaluated by ISO 3685

Cutting speed v_c [m.min^{-1}]	Cutting insert type	
	Pramet CNMG 120408E-FM, T9325	Sandvik CNMG 120408-PM, 4325
	Chip type / Chip lenght *l* [mm]	
80	arch loose / 6 ÷ 16	arch loose, arch connected / 4 ÷ 7
100	arch loose, arch connected / 4,3 ÷ 6,8	arch loose, arch connected, elemental/ 6 ÷ 8
120	elemental arch loose, / 4,3 ÷ 6,8	arch loose, arch connected / 6 ÷ 8
140	arch loose, arch connected / 4,3 ÷ 6,8	arch loose / 6 ÷ 8

Table of chip evaluation according to ISO 3685



Tool‘s real-time wear curves of CNMG 120408E-FM, T9325 for different cutting speeds

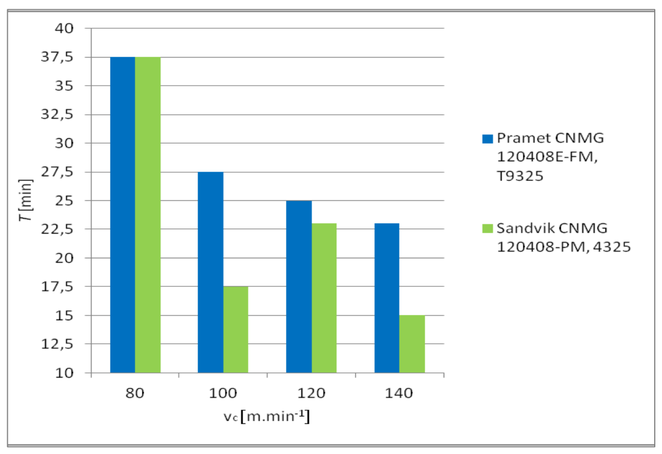


Tool‘s real-time wear curves of CNMG 120408-PM, 4325 for different cutting speeds

CONCLUSION

In the context of the presented experiment, the toollife of the above-mentioned cutting inserts was compared to steel class 1.4404 material machining. At all cutting speeds (except speed v_c = 140 m.min^{-1}, when life time was the same, the CNMG 120408E-FM T9325 had a better life time results.

The reason is probably that the Pramet insert has an average 3 µm thinner coating that might acts as a thermal insulator. Machining od stainless steel produce high temperatures and a thicker coating layer can prevent heat dissipation in the tool shank, which causes a greater load in the cutting area. During the measurement, were also evaluated chips by the cut-off method. According to ISO 3685 were most common arch loose, arch connected or elemental chips included. As expected, heat treatment had a positive effect. Good effect had modification by Sb, too. The presented results are part of a larger research, which is realized at FME JEPU in Ústí nad Labem.



Comparison of turning inserts life-time depending on cutting speeds