Here, we introduce the knowledge and various knowledge about the product TAKAMAZ a variety of machine tools.
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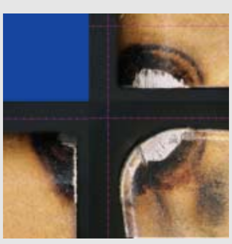
The 7th STAINLESS STEEL SUS304 HIGH-SPEED FINISH CUTTING

Stainless steel, once considered a hard-to-cut material, can now be processed stably in mass-production fields thanks to abundant cutting data and dedicated tools. However, not many technical data relevant to high-speed cutting of stainless steel have been disclosed and many feel difficulty in switching to mass-production. Here we will introduce high-speed finish cutting of stainless steel SUS304, which is used widely among various stainless steel materials, as an example.

Experiment 1: Checking Propagation of Wear

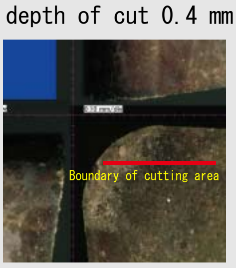
Tool: CNMG120408, equivalent to M25
Cutting conditions:
 Cutting speed 250 m/min,
 cutting distance 6 km,
 cutting time 15 min,
feed rate 0.12 mm/rev, depth of cut 0.4 m



Supposedly due to use of a broadly applicable material, coating is flaked causing considerable wear on the flank. We also found that setting the cutting speed a little higher significantly propagates wear.

Experiment 2: Finding the Suitable Tool for High-speed Cutting

Tool: CNGG120408 VP10RT
Cutting conditions:
 Cutting speed 300, 400 to 500 m/min,
 cutting distance 12 km,
 cutting time 30 min,
feed rate 0.12 mm/rev,
depth of cut 0.4 mm

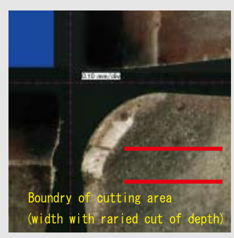


At the cutting speed of 300 m/min, nominal chipping developed at the boundary of the cutting area when cutting distance reached 3 km. However, propagation of chipping is not discerned after that and even at cutting distance of 12 km, flaking on the face is not observed and only small wear and deposits were found at the nose section. The condition of the corner did not change much from that of a new insert.

Selection of VP10RT, the heat-resistant steel material with sharp cutting performance, and setting the depth of cut to half of the nose radius for suppressing localized flank wear may have lead to the good results. In one reference document, a case where localized flank wear was successfully suppressed by setting the side cutting edge angle larger than 45 degrees was introduced. However, the tool broke after a cutting distance of 8 km at cutting speeds of 400 to 500 m/min due to localized flank wear and flaking on the face.

Experiment 3: Solution for Generation of Localized Flank Wear

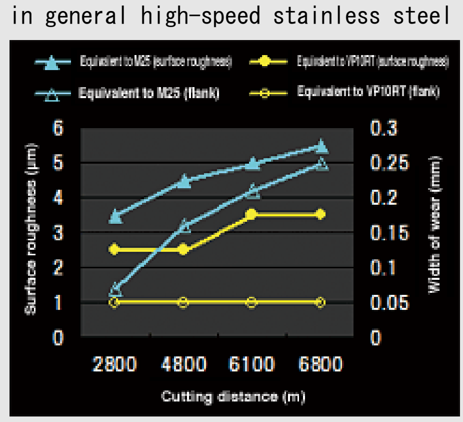
Tool: CNGG120408 VP10RT
Cutting conditions:
 Cutting speed 400 m/min,
 Cutting distance 12 km,
 Cutting time 30 min,
feed rate 0.12 mm/rev,
depth of cut 0.1 to 0.8 mm



Experiment 2 proved that localized flank wear has critical influence at a cutting speed of 400 to 500 m/min. Experiment 3 was conducted to check the effects when the depth of cut is variable in the range of 0.1 to 0.8 mm. At a cutting speed of 400 m/min, generation of localized flank wear was suppressed and tool damage was very small proving that varying the depth of cut is an effective solution. The reason for this is simply the fact that the boundary position on tool nose is changing. However, the effect was not achieved at a cutting speed of 500 m/min.

Transition of Surface Roughness and Flank Wear

With a tool equivalent to M25 for which wear on the minor flank is observed, surface roughness level also changed significantly as the cutting distance increased, showing the same tendency as in general high-speed stainless steel cutting.



Conclusion

With VP10RT, stable results were obtained in both surface roughness and width of wear area. Accordingly it is assumed that this tool can be used for finish cutting in mass-production of stainless steel parts at a cutting speed of 300 m/min. Previously, we introduced pure iron cutting and in that article we reported the optimum cutting speed was proved to be 300 m/min.
Taking the past test results and the current test results into consideration, it is most likely that some factor is affecting the finish cutting zone at a cutting speed of 300 m/min.
In zones where depth of cut is large, cutting with a variable depth of cut is effective. From the results obtained in this test, solving the localized flank wear problem is considered the most significant topic and we expect further improvements of cutting tools.