Here, we introduce the knowledge and various knowledge about the product TAKAMAZ a variety of machine tools. I hope you will help the daily work of customers

The 12th SMART GROOVE CUTTING

高松流技 TAKAMAZ RYU-GI

In groove cutting, there are cases where good surface finish and roundness are required depending on the dimensions a groove must provide. Although the walls on both sides of a groove can be accurately finished by cutting, it is not always easy to finish the bottom face to the specified surface roughness, dimensional tolerance and roundness for some kinds of workpiece material. This is due to the nature of groove cutting in which the entire width of a cutting edge engages in cutting. We studied a new cutting technique and conducted tests to find the limits of the achievable surface finish and roundness at the bottom face of a groove for the purpose of further study and improvement.

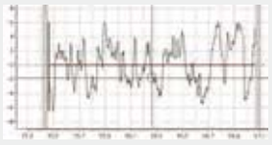
＊This new cutting technique which uses a special tool is now under feasibility tests and therefore will not be discussed in this article.

Test Environments

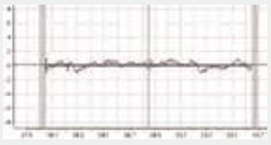
	General Cutting	Smart Groove Cutting
Workpiece material	S45C drawn bar	S45C drawn bar
Cutting speed	110m/min	250m/min
Coolant	0.1mm/rev	0.05mm/rev
Cutting oil	Water-soluble	Water-soluble
Tool	GBA43R300/PR930	TIALN coating
Machine model	TAKAMAZ X series	TAKAMAZ X series

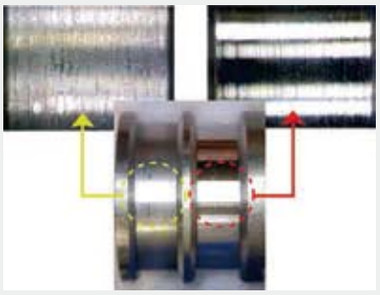
Test Results

General cutting: Surface roughness 12.0Ry(2.5Ra)



Smart groove cutting: Surface roughness 2.10Ry(0.25Ra)





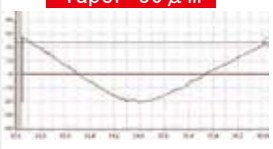
For the test, a drawn bar made of S45C which is prone to get a rough surface was used. Using a standard tool with the general groove cutting method, the surface finish deteriorated gradually, but using a special tool with smart groove cutting realized good surface finish. Although the material we used in the test is difficult to obtain good surface finish with, we believe good surface roughness can be maintained with other workpiece materials as well.

Other Features

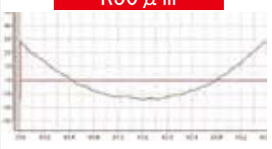
1. Cutting of groove bottom surface with gentle rounding or taper profile is possible.
2. High-speed groove finish cutting exceeding 200 m/min cutting speed is possible.
3. Can be applied to various kinds of workpiece materials including aluminum, casting as well as hard turning.

The figure below shows the results of test cutting by programming the groove bottom shape with 50 μm concaved into a tapered profile with corner rounding. We found that the contouring by the programmed values is possible.

Taper 50μm



R50μm

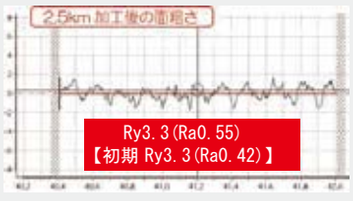


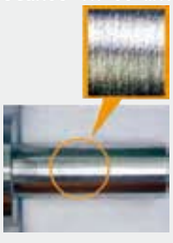
Purpose of Use

This cutting technique is used for improving the surface finish of the bottom face of O-ring grooves. In addition for OD turning operation where a grooving tool has to be used to avoid interference, surface finish improvement is expectable. In the future, this technique will be able to eliminate grinding operation after OD turning and extend tool life in cutting hard-to-cut materials.

Applications

The graphs below show the surface quality achieved in end face and OD turning on Super Alloy 718 (heat resistant steel). Cutting was possible up to 2.5 km cutting distance in 60 min.





Conclusion

The cutting technique discussed in this article is still under testing and we will continue further testing with various tool shapes and different materials. ID grooving will also be tested.