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.

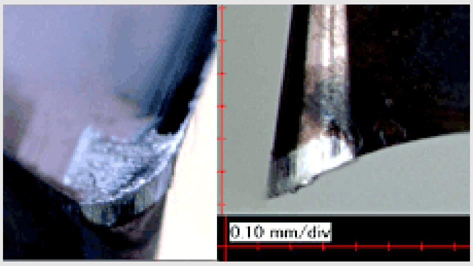
The 5th METHOD OF EXTENDING TOOL LONGEVITY IN ELECTROMAGNETIC SOFT IRON CUTTING

Electromagnetic soft iron is used in parts that require magnetic response, and the market demand for cutting this material is increasing.
When cutting electromagnetic soft iron, the tools are subject to steady and continuous wear such as from "abrasive wear", "diffusion wear" and "deposit spalling". However, due to the lack of studies and analyses of this tool wear, tool manufacturers still have yet to find a good solution in cutting electromagnetic soft iron. Focusing on finishing tools, we have obtained the optimum tool life extension method with the support of tool manufacturers. Here we will introduce the method as well as the process we took to reach it.

Experiment 1: Determination of the Test Tool

Cutting conditions: : V=150m/min、f=0.05mm/rev、D=0.4mm More than 40 kinds of inserts were tested and almost all of them showed a wear shape as shown in the photos below.

Photo 1

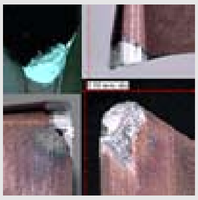


In the test cutting conducted for short distance 500 m, the flank was worn smoothly as if it were polished, and the coated layer on the face flaked along the chip flow. This wear, considered to be diffusion wear and abrasive wear, propagates continuously until the end of the tool life.
In Experiment 1, a number of tool manufacturer's inserts showed favorable results. Among them, we selected "KP006" (Sumitomo Electric Industries) for further testing with various cutting speeds and cutting fluids.

Experiment 2: Comparison by Changing the Cutting Speed

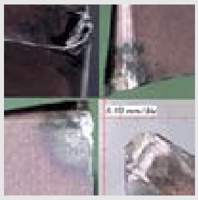
These photos show tool nose wear conditions after 4 km of cutting at different speeds. The face in photo 2 shows deposit generation but under the high-speed cutting in photo 4, deposits decrease. This implies that in high-speed cutting, the cutting temperature exceeds the temperature range where deposit generation easily occurs. From this we can see that cutting at high-speeds may be free from an inhibitor of tool life extension. In low-speed cutting as in photo 2, the wear is smooth and glossy, while in high-speed cutting it is coarse and burnt. It is assumed that this is because abrasive wear is dominant in low-speed cutting, and thermally affected wear is generated in high-speed cutting.

Photo 2



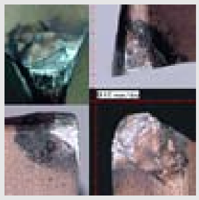
75m/min

Photo 3



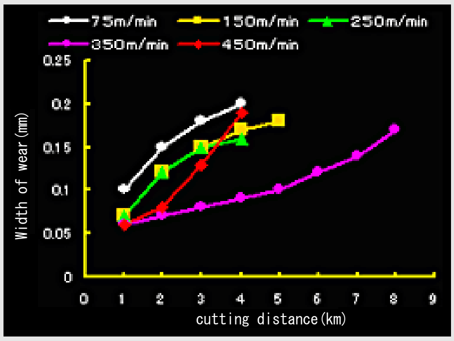
350m/min

Photo 4



450m/min

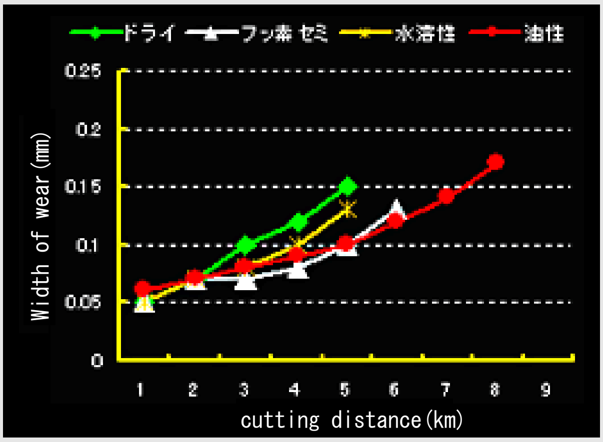
Amount of wear on minor flank (vs. cutting distance)



This graph shows how the width of the wear area on the flank changes according to cutting speed and cutting distance. At a cutting speed lower than 250 m/min, large initial wear is observed and propagation of wear is slowed as the cutting distance increases.
At a cutting speed higher than 350 m/min, initial wear shows a slow increase, but at 450 m/min, rapid propagation of wear occurs after 2 km of cutting. Analysis of this graph indicates that the wear factor differs at under 300 m/min and over 300 m/min, and that tool wear is minimal at around 300 m/min.

Experiment 3: Comparison by Changing Cutting Fluid

In Experiment 3, tool wear is compared by changing cutting fluid - dry cutting, semi-dry cutting with fluorinated fluid, water-soluble coolant and oil-based coolant. The experiment proved, as shown in the graph above, oil-based coolant gives the best result. In addition to this, although the width of the wear area on the flank does not change much, the localized wear on the face propagates remarkably with cutting fluids other than oil-based coolant and deforms the tool nose shape, reaching the end of the tool life before the width of the wear area reached 0.2 mm.



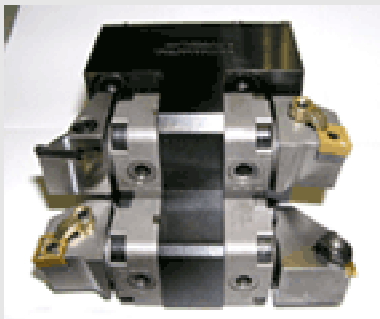
To Improve Tool Life in Electromagnetic Soft Iron Cutting

From the results of tests, we found the factors to take into consideration to extend tool life as follows. 1. Use oil-based coolant 2. To shorten cutting time per workpiece, select a high feed rate and a cutting speed as high as possible but under 350 m/min. 3. Set 0.2 mm or larger for depth of cut. 4. Select the appropriate insert type by testing several types since some types cannot be used for electromagnetic soft iron cutting. 5. Select an insert having a sharp edge and smooth chip breaker to reduce depositing.

Finally, we would like to briefly introduce the features of "KP006" which we used in the test. Among various features, the most notable is the super nano-micron thin film coat, which is called "SUPER ZX COAT". This super-thin film coating technology enables multi-layer coatings having different properties such as oxidation resistance, abrasion resistance and lubricity, thereby realizing a coating film with compound features. Whereas conventional coating can provide only a single feature, multi-layer coatings with contradictory properties can be created with this super-thin film coating technology. Therefore, inserts with multi-layer coating can be used in a wide range of cutting speeds from low to high and cope with complex wear factors.

Extra Information

Slashing turret change time on a compound lathe that features Y-axis such as Takamaz XY-120 and XY-1000.



The photo shows a combination holder where a total of four OD turning tools (two tools in the main spindle direction and two tools in the sub-spindle direction) are mounted on a single turret. With the tool tips arranged within the Y-axis stroke, tool change is possible by offsetting the Y-axis without requiring turret change. This feature can shorten cycle time and increase the number of mountable tools. Use of the KM tool (Kennametal Inc.) provides remarkable improvements in tool change efficiency. Note: Restrictions may apply due to part dimensions or interference. Will be released after June this year.