Kanazawa University

Our research and education are greatly supported by MTTRF. The students in our laboratory can conduct advanced research with state-of-the-art equipments. Students can also receive hands-on training on the basics of programming and operating of CNC turning center and vertical machining center.

RESEARCH

Cutting of Difficult-to-Machine Materials with PVD Coated Tools Deposited by FAD Method.

Typical hard coating films such as TiCN, TiAlN and/or AlCrN for cutting difficult-to-machine materials are deposited by Arc Ion Plating (AIP) or Hollow Cathode Discharge (HCD) process. These films have some significant disadvantages of formation of droplets (AIP) and relatively low adhesion strength (HCD). In this study, another type of coated films by Filtered Arc Deposition (FAD) method are formed, and applied to high-speed milling.

The coating films deposited by FAD method are very smooth without any droplets. The TiCN-coated end mill has good mechanical properties such as hardness and adhesion strength, and these tools are effective in high speed milling of prehardened steel compared with the commercially available HCD and AIP coating tools.

High Quality End Milling of CFRP Composite Materials

This study is to devise a new contour milling method of thermosetting CFRP composite materials without any subsurface damage. Types of DLC-coated, and diamond-coated end mills having different helix angles are selected and the influence of coating materials and helix angles on the machining characteristics are investigated.

Our proposed “Inclination milling”, in which the resultant cutting force acts parallel to the work surface, enables the reduction of tool wear and improves the surface integrity with

less delamination and fluffing, when performed with a high-helix angle end mill.

Turning of Difficult-to-machine Materials with High Pressure Coolant

The ultra-high pressure coolant (HPC/UHPC) is expected to improve the surface quality and tool life in turning of difficult-to-machine materials. In essence, HPC works by transferring heat away from the tool and part being machined into the coolant. Effective cooling of the machining zone helps minimize tool wear, prolongs tool life and provides the potential for higher cutting speeds. In addition, chip breaking effect is also expected by high speed water jet with ultra-high pressure.

This research focuses on the hard turning and/or mill-turning with the HPC system and to develop high efficient turning of difficult-to-machine materials. The influence of coolant pressure on the cutting temperature is currently examined.

EDUCATION

Mechanical Engineering Laboratory I & II (Undergraduate course)

Students learn the basic structure of the CNC machining center and how to set up and safely operate basic metalworking. They receive hands-on training on programming and operation. Turning experiments of medium-carbon steel with the carbide tool are also carried out and the cutting forces and surface roughness are measured. Students learn the cutting mechanism based on the experimental results.

Machining Technology (Graduate course)

In this class, each group spends two hours conducting a cutting experiment using the MTTRF equipment. In this experiment, cutting temperature is measured using a tool-work thermocouple technique in addition to the cutting force measurement.

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MTTRF Awardee since 2013