"O" flutes for mechanical plastics

by Van Niser

Mechanical plastics are steadily becoming the material of choice for the job shops and machine shops all over. These plastics have proven to demonstrate excellent performance in gears, bearings, material-handling parts and other machine components such as spacers and positioning mounts where reduction of vibration is essential. A few common mechanical plastics include: ABS, acetal, UHMW, nylon, polycarbonate, polyurethane and polyethylene terephtalate (PTE). These plastics have consistently demonstrated predictable performance because of durability, machinability and exceptional mechanical and electrical properties, and are replacing metal for parts manufactured to resist wear.

In terms of machining mechanicals, they can be classified as a soft plastic. Soft plastic utilizes "O" flute router type tooling that tends to curl a chip during the machining process. (Figure 1) This tooling has been designed to attack soft plastics with a high rake and low clearance geometry that actually carves the material. This tooling, when properly applied within a narrow range of chipload, typically 0.004" to 0.012", will provide an excellent finish in mechanical plastics. The consequence of improperly curled chips is visible knife marks that adversely affect the finish, which remains the most important consideration in plastic fabrication. (Figure 2)

"O" flute tools are manufactured from micro grain solid carbide tool material in straight and spiral configuration. The upcut or right hand spiral is most readily utilized because of the need to evacuate chip in an upward direction in flat sheet or block applications. The upward movement of chips avoids welding, which is a common problem in the machining of plastic. The tools are available in either single or double edge cutting diameters. A single edge tool is an excellent choice for most machining applications and can accommodate those situations requiring smaller diameters. The only caution with single edge tooling is to avoid using diameters over 3/8" because of balance issues associated with the tooling. If larger diameters are needed, the double edge alleviates the balance problem while providing a much improved bottom finish for slotting applications, which are prevalent in the machining of mechanical plastics. The double edge tools additionally provide longer cutting edges for deeper cuts of two to four times the cutting edge diameter at aggressive feedrates. (Figure 3 and Figure 4)

In shops with high feed and speed CNC routers, the use of router bits is common practice. The benefits of the tooling are understood, but this is not always the case in shops with CNC mills. In these environments, the tool of choice has traditionally been the endmill. These tools are intended for metal removal and do not possess the proper geometry to effectively machine mechanical plastics. Endmills have minimal rake and low clearance and were designed as robust cutting tools for heavy loads. Also, minimal flute area on these multi-edged tools interfere with the process of clearing chips, and this along with inappropriate geometry, can easily aggravate melting and reweldding problems common in mechanical plastics applications.

Besides the endmill dilemma, machining methodology in many shops remains constant because of past practices associated with milling metal. The feedrates and spindle speeds tend to be slow relative to the capability of today's CNC machining centers, and climb cutting with

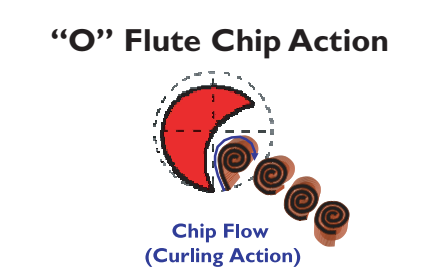

Figure 1

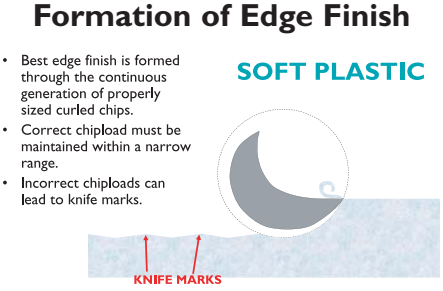

Figure 2

Figure 3
Single Edge Spiral
"O" Flute Upcut
63-750 Series

Figure 4
Double Edge Spiral
"O" Flute Upcut
52-700 Series

multiple passes are commonly utilized to enhance finish. These practices adversely affect productivity and profitability, and are the antithesis of the meaning of high speed machining.

The first step toward actual high speed machining is selecting an "O" flute router bit to machine mechanical plastics. The tool selection process is simplified by contacting a legitimate manufacturer of "O" flute router tooling with technical support capabilities. Once the proper tool is chosen, the user will be able to increase spindle speed and feedrate and boost productivity by 40 to 50 percent. In order to accommodate this process, the direction of cut in almost all cases will be conventional in nature.

Conventional cutting will provide a better finish by eliminating burrs associated with climb cutting, and inefficient finish passes are avoided in the process. Also, the geometry associated with the "O" flute router tooling allows the user to cut without the use of coolant. This becomes particularly important in industries associated with medical devices where contamination of the mechanical plastic can become an issue. The increased feedrates associated with the heavier chiploads increase productivity and dissipate heat thus eliminating the need for coolant.

Summary

The use of "O" flute router tooling represents a whole new concept in high speed machining of mechanical plastics. By selecting a tool properly designed for cutting soft plastics and by making a few basic changes in machining methods, the task of producing parts from mechanical plastics can be greatly reduced, and the potential of the CNC milling machine can be fully realized. ■

For further information, contact Onsrud Cutter LP, 800 Liberty Drive, Libertyville IL 60048 USA; (800) 234-1560, (847) 362-5028, fax (847) 362-5028, www.onsrud.com or plasticrouting.com.

QUICK FAQS ON KEEPING TOOLS SHARP

When is it time to have a tool re-sharpened?

When the cutting edge becomes dull. Some things to look for are:

- Surface finish quality will decrease.
- Amount of horsepower necessary to cut will increase.
- Noise level may increase.

What is the major cause of tools becoming dull?

Heat is the major reason tools break down and become dull. To reduce the amount of heat, increase the chipload. This will keep the heat in the chip and remove it from the part. After a cut, the tool should be cool to the touch.