Machining nylon and acetal

by Jody Walker

Nylon and acetal have a proven, successful performance record in a variety of diverse engineering applications, making these two materials the workhorses of the engineering plastics groups. The following paragraphs offer an introduction to the basic properties of nylon and acetal which may be relevant to machinists and fabricators. Machining offers many advantages to part designers. Machining nylon and acetal parts not only offer the economic advantages of providing parts in small or intermediate quantities but also allow design freedoms that can only be met by machining.

Nylon and acetal have unique characteristics that must be understood when machining. Considering these characteristics is critical to ensure the successful fabrication of precision parts from stock shapes of nylon and acetal. The following information just scratches the surface of the entire machining process, but these little tidbits of information are useful to know.

Specific applications can be met with Curbell Plastics' extensive Cast Nylons'® product line of high quality customizations such as inside and outside diameters on tubes, rings and discs as well as lengths on rods, plates and tubes plus widths on plates and rectangular bars.

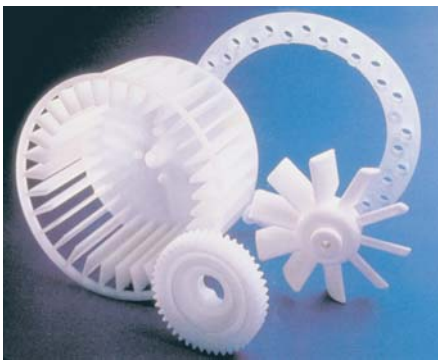
Improper techniques

Improper machining techniques can create large internal stresses that can result in warping and dimensional instabilities. Plastics are poor thermal conductors. Friction and pressure during the cutting operations tend to build up high temperatures near the cutter interface. If the part was metal, the heat would safely be carried into the bulk of the part and through the lathe chuck or fixture. Since the *thermal expansion* of acetal and nylon is up to 10 times greater than metals, high temperatures at the cutter interface will impact the machinist's ability to hold tight tolerances and can also induce internal stress.

Chip removal

Removal of the chip is one of the biggest challenges faced by machinists when machining nylon and acetal. If the correct tool is used, the chip will come off in a long continuous "string." The chip must be directed away from the revolving chuck so that it doesn't become entangled in it. One solution is to have air blowing through the spindle that then blows the chip through the back of the machine.

Another idea could be to set up a manifold with air pressure in a tube that vacuums the chip away from the machine. Some machinists could still have difficulty managing a continuous chip, and depending on part geometry an "interrupted cut" technique is effective. The procedure simply means that the cutting tool is pulled away from the plastics part surface for a split second during machining, thus stopping the cutting process and reducing the length of the "chip." This procedure has its merits but could affect surface finish and increase machine time.



Even the most demanding of bearing and wear applications sustain ENSINGER® acetals' superior machinability and natural lubricity including resisting stiffness and creeping.

Elasticity

Nylon and acetal are not as strong as metal and tend to be elastic. But nylon and acetal are notch sensitive. Typically designers simply transfer metal part geometries to their plastic designs. Sharp inside corners which are typically not as problematic for metal designs can concentrate stress in plastic components and should be avoided.

For instance, most thread designs feature sharp thread roots. No problem for a properly designed metal part, but for a plastic design which is stressed near the threaded fasteners *especially* if a thread-locking compound is used; failure of the plastic part due to stress cracking at the thread roots is a typical result. Machinists should broadly radius sharp inside corners as much as the design allows a limit or discontinue use of common thread-locking compounds on threaded plastic components.

Distortion or deflection

Nylon and acetal can distort or deflect due to their elasticity. Higher elasticity may mean that lighter cuts or different fixturing techniques utilizing double-sided

tape to hold the part in position versus "chucking it up" can be a useful technique to avoid distortion of the part during machining.

Adding value to your customers

The selling process tends to dominate our daily activities, but our customers machine the rod, sheet or tube we inventory into something and distributors should have a general knowledge of machining processes for plastic stock shapes. Most machine and screw machine shop customers primarily machine metals. Their trade periodicals and technical resource guides offer very little information on machining nylon and acetal.

Plastics distributors can add tremendous value by providing technical guidance to their customers. Being able to understand and communicate this information can help solidify relationships with customers. ■

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