Routing & Trimming Acrylics

Acrylics are a very popular thermoplastic because they have so many desirable properties and because they can be processed in several ways. Acrylics can be shaped by casting, extruding or molding to result in a material ranging from soft and pliable to rigid and brittle. These acrylics can be transparent, opaque or colored depending upon usage and can vary from thin sheet to thick solid surface materials.

The popularity of acrylics attests to the range of characteristics from optical clarity to rugged marble like surfaces. In all instances, however, acrylics can have excellent surface hardness, resistance to liquid, chemical and environmental surface damage and good thermal as well as mechanical stability.

Acrylic sheet products can be rigidized by thermoforming to a three-dimensional shape then spraying a fiber reinforced plastic underlayer. The resultant product has a glossy acrylic surface for desired finish and durability to aging and elements and a rigid underlayer for stability and load carry capabilities.

Usage of acrylic materials varies from aircraft canopies to lenses of all types for lighting, autos and enclosures. Sign makers utilize acrylics for weatherability, color, finish and backlighting capabilities. Bath bays, shower enclosures, panels and whirlpools are mainly rigidized acrylic materials. The recent success of solid surface materials made with acrylic based resins and mineral or inorganic fillers have attained popularity because of exceptional stain and scratch resistance. Newer applications for solid surface have included wall treatments, bath surrounds, furniture and architectural treatments. New applications for acrylics have also come from the marine industry. Work is being done on acrylic/ABS hulls to take advantage of the surface finish and corrosion resistance of the material. Smaller parts of many boats are now made with acrylic materials.

Machining acrylics can be quite easy or very difficult depending on the machining environment. Most cast sheet, once thermoformed, will be brittle and prone to chipping or cratering, if not machined properly. Thinner materials (under .375") can be trimmed quite easily with a single edge straight O flute solid carbide router bit (see figure 1). If several holes must be cut or if internal shapes must be routed, slow helix O flute spiral solid carbide bits are suggested. These bits are available in either an upcut (see figure 2) or a downcut (see figure 3) design. Usage of either will depend on fixturing, part hold down and desired chip flow.

FIGURE 1

FIGURE 2

FIGURE 3

Thicker acrylic materials (over .250"), particularly small parts cut from sheet, can best be machined in two passes. The first pass should be a skin cut .015" oversize and leaving .015" of material at the base. The second pass should then cut on size completely through the material. This system not only improves finish but eliminates the potential problem of the cutting tool contacting the off fall, dislodging the part causing scrap or tool breakage (see figure 4). Two tools are generally recommended for this modified skin cut system: either a solid carbide two flute upcut with acrylic geometry (see figure 5) or a three flute slow helix solid carbide finishing tool (see figure 6). Usage will depend on material thickness. Use the three-flute tool for over .500" thick acrylics.

FIGURE 4

In order to achieve optimum finish when machining acrylics, increased emphasis must be placed on finding the optimum feed and speed. If the feed rate is too slow or the spindle RPM is too high, several undesirable things can occur. If the cut chips are rewelding or scratching the piece part, if the piece part has a chalky or white finish or has scallops the feed rate and/or spindle speed must be adjusted to achieve a better finish and improve production. If spindle speed is 14,500 RPM, start feed rate at 200 inches per minute and increase until finish is optimized. If spindle speed is

FIGURE 5

18,000 RPM, start at 250 inches per minute. If spindle speed is variable, there is more latitude in making incremental feed and speed adjustments to optimize finish.

Machining solid surface acrylics is often done with hand held routers at the site where such counter tops or inlays are installed. Solid surface materials can be machined with solid carbide for straight cuts or with carbide tipped tools for profiling or straight cuts. Increasing applications for CNC are found in this solid surface market with the fabricators. All acrylics, in fact, are best machined on CNC routers where the controlled environment will lead to maximum productivity, better finish and increased tool life.