Working With Your UHMW

UHMW is a superb engineered plastic for food contact and abrasion resistance and high wear applications. Annealing (a cooling process that relieves stress), prior to machining, helps remove the stresses caused by manufacturing, especially in extruded materials. Finished parts can also be annealed, but the parts must be fixtured or secured during the cooling process to allow for shrinkage during the annealing process. Initial machining should be done prior to stress-relieving so dimensional changes can be accommodated during final machining. For flat parts, a final fly cut on both sides at the end of the process will ensure better results. You can also purchase the sheets or rod pre-annealed by request. Naturally there is a slight up-charge for the extra cooling time involved at the factory.

UHMW is available in standard sheets, rods and tubes for producing dimensionally stable parts and can be sawn, milled, turned, planed, laser cut, water-jet cut, drilled or punched. Cutting tools and drill bits should have high rake angles and sufficient chip clearance to prevent clogging. We suggest "O" flute construction for end mills and cutting tools when available. Keep your feed rates high, so that the cutting tool heat does not transfer to the material by encountering sustained friction. Keep your tools sharp because UHMW will rapidly dull tool cutting edges, causing dimensional variances. Better looking finishes can be obtained by using proper cutting tools, we discourage trying to improve poor finishes by sanding or using a file since this will generally result in worsening the appearance.

Most machining processes should be able to hold tolerances of between +/-.005 and +/-.010. Saw cutting strips to length, however, would more typically be +/-.030 since thermal expansion and contraction of UHMW makes the length of a piece vulnerable to environmental changes. The time you put into squaring your saw and getting your setup accurate will greatly affect your final tolerance when cutting UHMW.

Machining Processes

Sawing: For circular sawing, carbide-tipped blades give the best results. A 12-14" diameter blade should have approximately 24 teeth. Feed speeds can range from 10 to 40 feet per minute. For band sawing, a blade with three teeth per inch is recommended. Feed speeds range from 10 to 40 feet per minute. We recommend feather boards and fixtures to prevent kickback, and OSHA guarding for the blade.

Turning: Use high-speed steel tool bits with 10° front and side clearance and 15-30° rake. Lower cutting speeds of between 600 and 1,000 feet per minute are required. However, it is often necessary to run at a higher rpm to keep chips clear of the machine. Cutting fluids should not be necessary, but a blast of compressed air will sometimes aid in chip removal. When trying to achieve close tolerances or a very thin walled part in UHMW, machine in passes. Remove most of the material on the first pass, then let the piece sit and rest overnight.

Milling: Cutters designed for machining plastic are best, however cutters for aluminum also work well. Cutting speeds of 600 to 1,800 feet per minute are suggested, with a feed rate of approximately .01 inches per revolution. Router bits, especially "O" flute design, work well for slotting and light milling.

Planing: Wood planers readily reduce the thickness and true-up the surface of UHMW. A rigid machine with sharp blades will give very efficient stock removal and good surface finish. To minimize the potential to warp when machining UHMW, plane half the desired thickness from each side of the sheet.

Drilling: Conventional high-speed drills are adequate for most drilling applications. For optimum performance, use special low helix drills with polished flutes. Drilling pilot holes prior to drilling a large hole is not recommended for UHMW because its properties cause the drill to grab and pull itself into the material.

Grinding/Sanding: Due to UHMW's abrasion resistant properties, grinding and sanding are usually ineffective. In fact, grinding may cause the material to melt and smear, resulting in a clogged grinding wheel. Some shops report reasonable results using 3M Nylon sanding pads (like the green one in your kitchen) for taking edges off sharp sides or for minor sanding requirements,

Welding

Yes, UHMW can be welded. Virgin UHMW is preferable but factory regrind is also weldable. Some UHMW with silicone and other additives is not weldable. Also some colors cannot be welded because of the types of pigments and dyes used. The only way to know if it can be welded is to try it.

Recommended Tools The welder that some recommend for welding UHMW is the 2001 FC Seelye welder. The welding rod that you could use is 3/16" HDPE. You will also need to purchase a 3/16" welding tip.

Requirements for Air Supply and Electrical Source You must have a clean dry air supply with a minimum of 50 PSI and 5 CFM. You can use compressed air to weld UHMW but this does produce smoke and ventilation is required. Nitrogen can also be used and it will not produce smoke. Both air and nitrogen will produce the same quality weld. You will need a 20 AMP circuit, 120 volt.

Forming

UHMW can also be hot-formed on the job to make simple bends and angles that facilitate installation. No matter which method is chosen; a torch or propane flame, an electric heater, or put into an oven or dipped into a heated oil bath, we recommend caution. Every effort should be made not to overheat the material. UHMW, like any plastic, will burn under improper conditions. Think candle wax. In addition, the cooling cycle will be longer than the heating cycle due to the high heat retention characteristics of UHMW. Cooling should not occur on concrete or metal surfaces because the process will be too rapid and may introduce additional stress into the material. An additional recommendation is to cover the material with an insulation blanket made from a material such as fiberglass.

Cold-forming UHMW is often used when there is a need to fit curves and angles. Whether using a brake press, rolling, hand-forming or using bolts to draw and form the piece in place, the angle and curves must be over-bent by as much as 75 to 100 percent to compensate for the spring-back effect of UHMW. The potential for stress cracks can be reduced by using sheets 3/8" or thinner when cold-forming and by using virgin material.

Spin or frictional welding can be achieved using a standard machine lathe capable of 550 to 650 rpm with the ability to stop turning the instant the brake is applied, and a metal backup plate of 1/4" steel, with a diameter of slightly less than the flange OD. This kind of weld needs 48 hours to fully crystallize before the pipe can be put into service.

Butt, or hot plate welding to join flat sheets into long pieces or coils, requires the use of a metal heating tool, coated with a non-stick agent, capable of reaching the necessary temperature to bring UHMW to a molten state. This process requires the use of special welding equipment to achieve uniform welds with a strength of between 85 and 100 percent of the original material strength.

Adhesives

The low coefficient of friction, non-porous surface of UHMW makes it difficult for any adhesive to penetrate into the polymer and form a bond. Consult your adhesive supplier for recommended procedures to bond UHMW to various substrates, although mechanical fasteners are recommended for most applications. Epoxy will work if correctly used but the rigidity can be an issue and of course, it is not food contact.

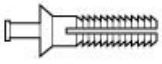
Mechanical Fastening

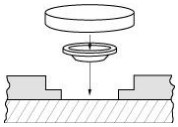
DO NOT attempt to use power nail guns, either air-powered or the ones with the explosive charge, to fasten UHMW. The nail will either ricochet or jam in the tool, causing a potentially fatal buildup of pressure within the tool.

Weld washers with UHMW caps are an excellent choice and drilling and bolting work well too. Slots are best, rather than circular holes, due to the thermal expansion of UHMW. We suggest as few fasteners as possible, preferably one on the inlet end of your line. When possible, free floating wearstrips perform best in conditions where temperature approach 160 F or higher. Nylon self locking nuts are an excellent choice.

Plastic pop rivets are also an excellent choice when fastening to sheet metal surfaces.

Slot at input end of wearstrips





weld washer with plug