# Tips for Surfacing and Finishing Lenses Made from Trivex™ Material

Looking back at days when polycarbonate lenses were introduced, industry veterans will recall having to learn a whole new set of skills to surface them properly. In contrast, optical laboratories will be pleased to find that surfacing lenses made from *Trivex* material is as easy as surfacing other plastic lens materials; and with a little refining, most of the techniques used for other lens materials can be used for lenses made from *Trivex* material. As with any lens material, there are a few basic lab techniques one should know to improve their final results. The following recommendations are provided for both novice and experienced laboratory personnel.

## SURFACING RECOMMENDATIONS

### Base Curve Selection

Many of the lens manufacturers who work with *Trivex* material produce their single vision lenses with aspheric base curve designs. It's important to choose a base curve that is within the specified range for the power that is needed. Manufacturers have base curve selection guides to assist you in this step. Some of the newer surfacing software will specify which base curve to select. Going outside the recommended parameters will cause adverse power problems for the eyeglass wearer. This is true of any lens made in any material and is particularly troublesome with aspheric designs. Eyecare professionals who specifically request base curves outside of the recommended range for a specific Rx should be informed that the lenses they receive may not provide the level of aberration control and vision correction they expected from the design they ordered.

### Surfacing Layout

Single vision aspheric lenses made from *Trivex* material have a specific factory-marked base curve center on the blank. This point is the apex (or steepest part) of the curve that defines the lens' asphericity. This center should coincide with the optical center after the lens has been surfaced. If it does not, the lens (depending on power) may have undesirable and unpredictable multi-axis cylinder and may need to be remade.

Double aspheric lenses have an axis marking line on them that must be properly aligned with the Rx axis. These markings can be prevented from coming off when the surface protector tape is removed if a piece of disappearing cellophane tape is placed over the markings prior to applying the surface protector tape. These markings will be used to verify that the lens' optical center and axis are aligned with the aspherical apex during finishing layout.

In order to obtain the full optical and cosmetic benefits that lenses made from *Trivex* material have to offer, it is recommended that layout computing be completed with software that is specifically designed for these lenses. The combination of aspheric design, 1.53 index and minimum thickness variances requires this upgrade to your layout program.

## Surface Taping and Blocking

Photo courtesy of Younger Optics

As with any plastic lens material, the base curve of the lenses made from *Trivex* material should be covered with surface protecting tape prior to blocking and generating. The front of these lenses has a built-in, protective, scratch-resistant layer, but shielding the lens with surface protector tape offers enhanced scratch protection and provides a better bond for the surfacing block. There is also an increased amount of torque created when surfacing this material and the surface protector tape will help provide a good bond with the surfacing block.

Heat is always an enemy of plastic lenses so the less heat lenses made with *Trivex* material are exposed to, the better they will turn out. That is why a low temperature alloy or wax blocking method is recommended for blocking lenses made from *Trivex* material. Be sure to allow adequate cooling time after blocking so that the blocking bond is optimal and the lens is not stressed from the heat of the blocking process.

## Generating

There are two basic generator types used in today's optical laboratory. Different procedures are recommended depending on the type of generator being used.

## Manual Sweep Arm and Diamond Quill Generators

A combination grit diamond quill meant for both *CR-39* monomer and polycarbonate will work well with *Trivex* material. It is best to run the coolant throughout the manual generating process. Generator operators should use slightly slower sweeps and take less thickness off with each sweep than they normally do with polycarbonate. There is an increased amount of torque produced during the grinding process on lenses made from *Trivex* material, so slow things down a bit. A very slow final sweep with a minimal thickness cut and with coolant running will give the lens an excellent pre-fining surface.

A fluffy, wool-like swarf that can clog the coolant drain is produced when generating lenses made from *Trivex* material in a diamond generator. Be prepared to clean out the swarf trap after generating each lens.

## Single-Point CNC Dry Milling Generators

A two or three flute cutter will work best with *Trivex* material. Cutters must be sharp in order to produce the best surface quality. If the generator has an optional cribbing setting, use it. This is because edging lenses made from *Trivex* material causes a lot of torque so if the lens diameter is minimal, there will be less torque. This helps keep lenses on axis during edging.

Using the pin bevel setting on a dry mill generator will help reduce wear on your fining and polishing pads and eliminate sharp edges.

## Thickness

While lenses made from *Trivex* material have excellent impact resistance with a 1.0mm center thickness, they may warp over time if placed in frames that exert significant pressure around the lens' circumference. Because of this, some labs add 0.2mm to 0.3mm of thickness to the lenses. The extra thickness does not alter the final appearance of the glasses noticeably (for example, a 1.0mm edge vs. a 1.3 mm edge) and can help avoid the potential warping problem.

## Fining

Photo courtesy of HOYA Vision Care

Some laboratories may choose to use a two-step fining process to surface lenses made from *Trivex* material. When doing so, use compensated lap tools. These tools have been cut with a slightly steeper curvature to allow for pad stacking. If a second fining pad is stacked on top of the first fining pad, it adds diameter to the lap tool curvature which can cause a noticeable power error in these lenses depending on the lens' power. Compensated laps correct this problem. Single-use foam lap tools must also be cut to compensate as well.

Fining pads made specifically for lenses made from *Trivex* material usually have grit ratings of about 300 for the first fining and 1150 for the second fining depending on the pad manufacturer. Some labs find that the pads they use for polycarbonate lenses work well too since there is little difference in the grit sizes of 280 for the first fining and 1000 for the second fining.

Be sure that cylinder machines are adjusted to their fully-recommended sweep and stroke settings (on most cylinder machines this will be about 28mm tall for the stroke by 62mm wide for the sweep). If they are not, there may be areas on the lenses that do not fine completely.

Use a slightly lower pin head pressure than the usual 20 psi (about 18 psi), a timer setting of 1.5 – 2.0 minutes and the slow speed setting on your cylinder machines for lenses made from *Trivex* material. These lenses fine out very easily compared to polycarbonate and do not require much excess pressure or time to bring them to an excellent finish. Do not over work these lenses; it simply is not necessary.

## Polishing

Some laboratories have found that polishing pads and polishes designed specifically for *Trivex* material work very well. Other laboratories have found that they can use pads and polishes recommended for polycarbonate with good results too. Lenses made from *Trivex* material tend to be very forgiving to the surfacing process as long as the process is not rushed.

## Backside Scratch-Resistant Hard Coating

Even though lenses made from *Trivex* material are considerably more scratch resistant than uncoated polycarbonate lenses, you will still want to add a backside scratch-resistant hard coating. A good quality UV cured tintable coating will improve scratch resistance as well as enhance the tintability of these lenses.

## Anti-Reflective and Mirror Coating

In general, AR and mirror coating techniques that provide good results for other plastic lens materials work well for lenses made from *Trivex* material also. As with other lens materials, a good scratch-resistant hard coating is an essential part of the AR and/or mirror coating's success. Coatings adhere well to lenses made from *Trivex* material. Therefore, washing lenses with soap and water is preferable to etching prior to coating. Some coatings can have a detrimental effect on impact resistance.

## Lens Inspection

As mentioned earlier, the center markings on single vision aspheric lenses made from *Trivex* material must align with the optical center after surfacing. Measure the lens thickness using a lens caliper and visually inspect the lens for any flaws before moving on. Lenses that consistently come out with waves or warpage suggest that there was too much heat or pressure applied during surfacing. Check the chiller and coolant waters in the generator and cylinder machines to ensure they are keeping the lenses cool at all times. Double check the pin head pressure on your cylinder machines to be sure they set properly (around 18 psi).

# FINISHING RECOMMENDATIONS

## Finish Blocking

A high quality pad should be used to block lenses made from *Trivex* material. Pads that stretch too easily may cause axis problems. Also remember, the smaller the diameter and the thinner the lens blank edge is, the less torque there will be in the edger, helping to keep things on axis. Be sure to use the correctly curved block for the lens' base curve. Lenses made from *Trivex* material have a little flex in them so using the wrong shaped block may damage the lens when it is chucked in the edger. Flexible plastic blocks work well to reduce this problem but avoid using older over-used plastic blocks that could cause axis problems. Chucking pressure should not exceed 20 psi or be less than 18 psi or the metric equivalent of 80kg.

## Edging – For Dry, Blade Style Edgers

A dry, cutter blade edger provides excellent edging results with lenses made from *Trivex* material. Good sharp cutter blades will not only cut the lenses easily and with very little additional torque, they will also produce a semi-glossy edge that some technicians feel needs no additional edge polishing. For semi-rimless chord mounted jobs, it is advisable to use the semi-rimless blades that automatically groove the lenses, if possible. This saves time and an additional step in the groover. It is also not necessary to clean out the melted swarf that accumulates in a manual groover with *Trivex* material.

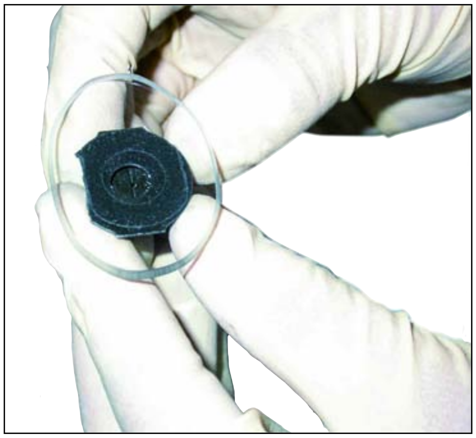

Photo courtesy of Younger Optics

An airborne particulate and a distinctive smell can be created when edging lenses made from *Trivex* material. To help reduce the particulate and scent, use a dry-cut cycle that has a vacuum to collect the dry swarf if possible. It may be advisable for lab techs to wear a dust mask during the edging and surfacing process.

## Edging – For Wet-Sump Diamond Wheel Edgers

Having a wet edger with the correct diamond wheels is one of the most important factors in getting lenses made from *Trivex* material to finish on axis and with a high quality bevel. The recommended diamond wheels have diagonal slots or a series of holes in either of both the roughing wheel and the beveling/finish wheel. The purpose of these slots/holes is to allow for cooler roughing and beveling cycles. The diamond grit on these wheels is very much like the grit on conventional polycarbonate stones and they work well on all types of plastic lenses.

If the edger has a "*Trivex*" setting it should be used. Most older edgers will not; in which case the, polycarbonate setting will work best. Lenses made from *Trivex* material should be rough cut and rough-finish cut dry (without the coolant water running on the wheels). Coolant water should be running on the final finish edging cycle to bring the bevel to a smooth finish. If the machine has an edge polishing wheel, use the coolant water on this cycle, too.

There will be a noticeable amount of melted swarf coming off the lenses during the rough cycle which can form into hard chunks. These fragments may clog the swarf drain in the edger if the machine does not automatically wash them away. They can also get wedged between the diamond wheels and the grinding chamber walls, causing a loud bang when they dislodge and propel back into the grinding chamber. Because of this, it's important to be very cautious and wear safety glasses while edging lenses made from *Trivex* material.

## Sizing and Bevel Placement

Lenses made from *Trivex* material maintain their size and shape well over time and do not need to be edged large to compensate for shrinkage like some materials. Cut these lenses right on size.

*Trivex* material hand edges slowly on conventional grit ceramic-pin-beveling hand stones. Use a dual grit hand edger stone with a coarser grit on one side and a finer grit on the other side in order to hand edge it effectively.

## Manual Edge Polishing

The automatic edge polishing function (on edgers that have it) give lenses made from *Trivex* material a shiny luster and is a convenient way to edge polish these lenses. For labs that use manual edge polishing equipment, use a fresh, new felt polishing pad or muslin buffing wheel in conjunction with a high-quality dry polish stick designed for polycarbonate. This dry polish has a lubricating wax in it that will help keep the lenses from getting pits in them from too much heat. Always protect the lens surfaces with surface protecting tape before polishing. Use as little of the polish stick as possible and use very little pressure when polishing. Avoid polishing the apex of the lens bevel, if the lenses were cut exactly to size, or they may turn out too small. Manually bringing lens edges to a high gloss takes a little time so be patient and do not overheat the lenses or they will blister.

## Manual Grooving

Manually groove lenses made from *Trivex* material dry (without using water). After grooving, clean the excess swarf out of the groove with an optical screwdriver, or similar device, the same way as with polycarbonate. This removal will be a little easier with *Trivex* material than it is with polycarbonate because the swarf comes off in long strands.

## Computerized and Manual Drilling

Lenses made from *Trivex* material are ideal for rimless eyewear. For drilling tips, see the section entitled, "Drilling."

## Tinting

Tinting lenses made from *Trivex* material is as easy tinting any other plastic lenses. Consult the "Tinting" section of this manual for tips on getting the best results when dyeing these lenses.

## Mounting and Inserting

If properly edged and sized, lenses made from *Trivex* material will have a high-quality edge enabling easy glazing. These lenses should not be glazed too tightly or they may warp, causing distortion and stress aberration.

Be cautious when glazing lenses made from *Trivex* material into plastic frames using a heating pan containing glass beads or salt. Excessive heat can blister the lenses, so a hot air frame warmer is recommended for this task.

Use standard mounting and insertion techniques to glaze lenses made from *Trivex* material into metal and semi-rimless frames.