What you need to know about turning plastics

Kurt Hertzog introduces us to the topic of turning plastics

The discussion of plastics can get out of hand very easily. Like the number of species of woods, there are thousands of variations of the materials we lump under this term. The woodturner turning a piece of plastic may not have the faintest clue as to the type of plastic they are dealing with. They may have found it, been given it, bought it or cast it, but will likely not know much about the type, characteristics or other issues that are key to their success at turning and finishing it.

The information received when you buy plastic is often inaccurate, unless you purchase it from a plastics dealer or a woodturning retailer having it specifically produced for them. Even knowing the family of plastic your material falls in doesn't offer much help. Much like species of woods, the variants within families can exhibit vastly different cutting, sanding and finishing characteristics. In spite of the huge array of plastics that today's woodturner will potentially encounter, I'll offer some techniques that should help you find a successful way to turn and finish it.

Plastics basics

Simplified to the max, there are two types of plastics you'll encounter. Thermoplastics can be formed, moulded, shaped or otherwise altered with the addition of sufficient heat. When cooled, the altered shape remains. The process can be repeated over and over. As such, they need to be worked by the woodturner without building up too much heat. If you cut or sand adding too much heat, the plastic will soften and can flex or change shape. The other family of plastics and thermosets are a one-way trip. When processed, the plastic is cross-linked, forming the finished shape forever. Adding heat really doesn't do much to the material except heat it up and with sufficient heat, degrade it. Some of the thermosets you may have heard of are Rhino Plastics, Inlace or DuPont Corian. Other familiar names might be of thermoplastics, such as Lucite acrylic or Lexan polycarbonate. If you are casting polyester resins, you are creating a thermoset blank. Not technically, but we'll included adhesives used as fillers or elements in our creations, especially the coloured ones. We'll treat them like plastics.

PHOTOGRAPHS BY KURT HERTZOG

Your source of plastics may be found, given, bought, or cast. The family is huge and there isn't one answer to fit all

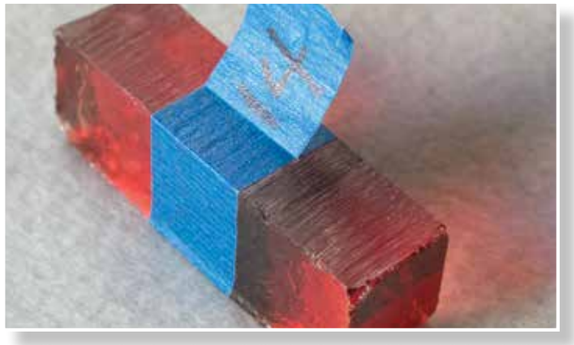
KEY POINTS ON PLASTICS

1. Keeping things cool is good practice regardless of the plastic type
2. Plastics is a huge family of variants on the same order as wood – all a bit different
3. Some are brittle and chip easily, so use a light touch and sharp tools
4. Take the manufacturer's information to heed, but be wise about learning

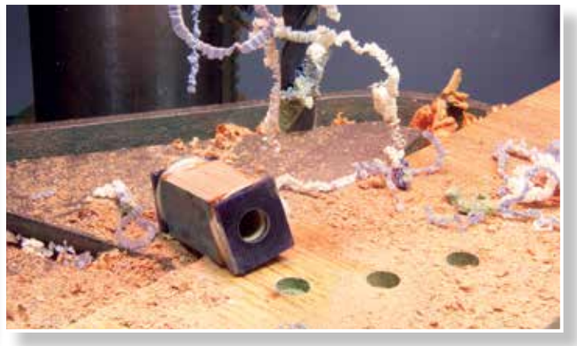
SAFETY

The plastics we'll encounter as woodturners can be used in the same manner as wood. Eye protection is a given and using dust extraction is wise as you would for any airborne material when cutting and sanding. If you are casting your own materials such as polyester resins, follow the ventilation and other PPE instructions per the manufacturer

LEARNING AHEAD OF THE GAME



The chipping on the edges gives an indication that this might be brittle and chip easily when cutting. The number label helps me keep track of material batches



The long strings of plastic from the drilling are a good indication of a thermoplastic that will cut nicely with a cutting tool rather than scraping

Embedded materials for colouring, as opposed to chemically altered, are a separation waiting to happen. Use caution when processing. Be gentle!

With care, embedded material plastics can be turned and finished. High speed, light touch and cool processing will be the keys to success

If you know your material and know how it will cut and finish, you can launch right into work. If not, you can easily learn enough to make good decisions about how to proceed or even whether to proceed with the material you've chosen. With material preparation for turning, you may have a host of opportunities to learn about your plastic. Cutting it on your bandsaw or doing drilling provides a wealth of information. You can usually learn if it is a thermoset or a thermoplastic. You now know the heat sensitivity; you'll also know the hardness. That will provide a great starting point for what tools and techniques will work best. Using a scratch awl to score the surface will indicate the hardness and brittleness. Not always true, but for the most part, thermoplastics are relatively soft and thermosets are hard. Drilling discharge and the hole finish will show the tendency to remelt or be stringy. A good indication of a thermoplastic that will require cool processing. Chipping of the blank at the bandsaw or drill press will forewarn you of a difficult plastic to process. You'll have the likes of purpleheart (*Peltogyne porphyrocardia*) or wenge (*Millettia laurentii*) on your hands. Even if you don't have the need to cut or drill the blank ahead of time, cut a small sample and turn it. Much like testing your finish on a hidden area of your final piece, you'll learn how it will look and act. Do the same with your plastic if you have doubts. Cut, drill, or turn a small sample to be certain you know how it will work for you. Take it to the final step, including finishing, to be certain it will take and hold the surface finish you want.

KEY POINTS ON LEARNING

1. Try a sample piece from beginning to end prior to making a big commitment
2. Use a scratch awl across the surface to learn about hardness
3. Don't be afraid to rethink your choice of plastics based on your sample piece
4. Once learned, document that material's characteristics for future reference
5. Thermoplastics will require you to be cautious of excess heating

CUTTING PLASTICS

This was the easiest part of the article to write! Cutting plastics is identical to cutting wood. For the most part, use fast-yet-safe speeds, sharp tools and light touch. The speed should be as fast as is safe, based on the size of the turning and your skill sets. The surface feet per minute of the tool, along with the light force and sharp edge will do you well. Since you've already tested any unknown material, you'll have an indication of whether it likes to be cut or scraped. A very broad generalisation is that thermoplastics would rather be cut than scraped. Thermosets really don't care. Of course, both will let you scrape as needed, depending on where you are and what the geometry is you are trying to accomplish.

The biggest problems you'll likely deal with is the winding of the long strings of thermoplastic cuts around the turning and the static charge that will stick the plastic cuttings to everything. Pick any tool you feel comfortable with, be certain it is sharp, and present it with a light touch to be successful. The only time I resort to scraping is for the chippy brittle stuff. I've never found the use of a negative-rake scraper to offer advantage. Use a standard scraper with reasonable contact area and little to no burr. Other than that, I find a cutter is far easier to use and leaves a better surface finish for sanding. Plastics are rarely completed right off the tool. Even with the use of a skew chisel, the surface dimension, flatness and finish can be improved by sanding. Because you'll be sanding anyway, I find that getting my turning close to finished shape and dimension then sanding to completion is far more effective. There is no shame in sanding – it is a cutting tool after all. The proverbial joke about the 60 grit skew chisel might be funny at your local turning club, but using what is most effective saves time and energy. With a properly completed turning, nobody knows how you got there. I get the best surface finish that I can cutting the plastic close to finished size and shape, then proceed to the sanding and finishing stages.

KEY POINTS TO CUTTING PLASTIC

1. Cutting is usually far more successful than scraping, unless the material is 'chippy'
2. Scrapers work better with a small or no burr, light touch at safe yet high speed
3. Get to near finished shape with cutting, then finish with sanding
4. Keep heat buildup to a minimum
5. If you overheat the material and it softens, let it cool to solidify again, then proceed
6. Turn off the lathe in order to clear the static attached or wound up stringers. Always remember – safety first!

Thermoplastics usually like cutting better than scraping. A spindle roughing gouge works quite nicely if sharp and presented properly

Thermosets are easily worked with cutting tools. The material cuts nicely with whispy curls possible, which creates a very nice surface finish

Scraping can be done on both thermosets and thermoplastics, but only as needed. The best use of scraping is brittle, chippy materials. Light touch means minimal burr

Depending on the hardness, plastics will hold nice detail – especially thermosets. A sharp detail gouge will work quite nicely to cut in features

A sharp parting tool will work very nicely, not only on tight spaces, but also in the open. Basically a skew chisel, it will create very nice straight sections

In contrast, a piece of Ebonite after a bit of heavy-handed turning. Plastic is worked far better with light touch and sharp tools. No need to beat the materials

ADDITIONAL OPERATIONS

Because wood threads poorly, plastic parts or inserts are often used to take the threads needed for a turning. Plastic has no grain to be cut across weakening thread formation or durability like wood. That said, each plastic has its own characteristics and each will take threads a bit differently. Most thermoplastics can be threaded, but are usually threaded using a tap and dye. Because they require a tap and dye, the size of the threads is limited by the availability and the cost of the hardware. Pen makers will often use thermoplastics for their pens and cut the appropriate threads into their work. Because the stress on the threads is light, the material takes the threads nicely and will endure reasonable use over the lifetime of the turning. Thermosets lend themselves to both tap and dye cut threads and hand-chased threads. The hardness of the material is the key. For hand-chasing threads, you need a bit of hardness to help with the process. When selecting woods, the hardness and density makes for success. With plastics, it is the same thing. The beauty of hand-chased threads is the ability to do it in any size at a reasonable cost. Sizes and threading that would be prohibitive in taps and dyes can easily be done with hand-chasing tools. Plastics will also lend

themselves to machining operations, laser marking and just plain filing. If you want flats or grooves on your turnings, a plastic blank will accept milling machine or router operations nicely provided the speeds and feeds don't overheat and melt things. In the past when I've needed flats, I've simply used a machinist's file and locked the headstock at the various rotational points. Your plastic blank will accept just about any additional operations you wish, just as long as you keep the temperature limitations in mind.

Thermoplastics will take internal and external threads quite nicely. These are usually cut with a machinist's tap and dye

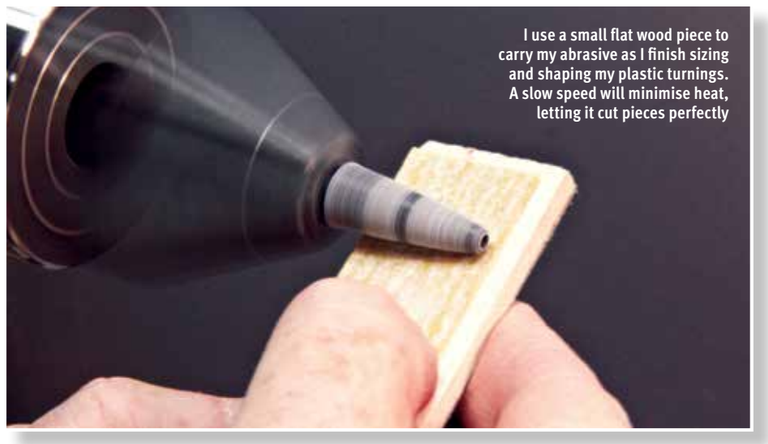
Thermoset plastics, being harder and usually denser, lend themselves to being threaded using hand-chasing tools. They will take and hold threads strongly

KEY POINTS ON ADDITIONAL OPERATIONS

1. Thermoplastics are well suited to tap and dye operations
2. Thermosets will accept threads readily from tap and dye or hand chasing
3. Milling machine type operations are well accepted within temperature bounds
4. Simple hand filing, flats, and spirals are easily done for enhancement
5. Laser marking of patterns and pictures can be done and is especially handsome with colour fill

SANDING AND FINISHING PLASTICS

Because I use the sanding process to get to the desired size and contour endpoint, I leave things a bit proud and then sand to my desired endpoint. I use small pieces of abrasive, coarse enough to get the job done at slow speed, backed by a small piece of wood. The wood isn't a thermal barrier; it is a support to keep a straight flat surface. If I want to create a contour, I simply use my fingers or the properly shaped backing support. Once shaped as desired to a size just proud enough for finish sanding, I use the same practices as for sanding wood. If you are sanding with the lathe running slowly to minimise heat build up, work through the grits once you've finished with the prior grit, clean off the debris and take the surface finish to the level you want. Added to the standard good sanding practices would be the additional materials that you can use to take the surface finish to the next level. The standard abrasives with the intermediate grits let you work the surface, prepping it for the next grit. Always clean between grits and don't move on to the next step until you're ready. You can continue up into the automotive refinishing grits in the thousands, but I find moving to Micromesh once I've passed 400 works well. Starting at the coarsest Micromesh once you've finished with standard 400 abrasive and continuing through their nine steps will usually take you to as high a gloss as you wish.



I use a small flat wood piece to carry my abrasive as I finish sizing and shaping my plastic turnings. A slow speed will minimise heat, letting it cut pieces perfectly

KEY POINTS TO SANDING AND FINISHING PLASTICS

1. Good sanding practices apply to plastics many times over
2. Scratches in plastic are easily seen and never will go away
3. In addition to the standard kit, there are special abrasives and polishes for plastics
4. Liquid plastic finishes are really a polishing compound. A carrier with fine abrasive particles
5. Good mechanical tooth or ability to soak in is needed for any finish to bond well. Smooth plastic surfaces present problems
6. Added finishes are relatively fragile – best used for appearances only
7. Always test technique and finish on a sample prior to committing
8. When using a combined wood and plastic, finish each individually with their own finish and technique

In addition to standard abrasives, a set of Micromesh, buffing wheels and media, and the various compounds with minute abrasive particles are helpful

Wet sanding works well with plastics. While I don't wet sand with standard abrasives, I find it beneficial when using the Micromesh or very fine auto papers

A good source for clear acrylic is old trophies. When cut, the material frosts. With proper sanding and buffing, it can be brought back to optically clear

Every plastic I've worked with can benefit from buffing once the sanding and Micromesh process has been completed

CONCLUSION

The huge array of plastics available adds many options to the woodturner's palette. Because they offer so many colours, textures and strength options, it is hard not to want to incorporate them into your turning. Whether you want a strong durable 1.02mm wall thickness or a 50mm-10 pitch thread, you can find a plastic that will let you do it. If you want a solid surface material where the colour will never wear through, there is a plastic that will do it. There are only a few plastics that I would class as more trouble than they are worth. For the most part, you have the tools and the know-how to deal with them. It isn't difficult, but learn about your material. Testing a sample before betting the ranch is a wise idea. The few moments you'll spend on cutting, turning, sanding and finishing a small test block of your material will be a wise investment. You might even want to buy a small block to test before you purchase a larger quantity; that will ensure you don't end up with a larger quantity of material you don't want to work with. The marriage of woods and plastics offers many opportunities to create unique turnings. Other than perhaps a few plastic polishes, you likely already have everything you need to turn plastics. You don't even need to buy plastics – you may well have an old trophy or bowling ball lying around in the shed. The opportunities are all there. Don't be scared; give plastics a try. ●

The ability to create thin strong walls or take and hold fine to coarse threads gives thermosets and the other plastics a home in my woodturning

You can easily drill a 75mm hole and turn it to a strong, durable wall thickness of 1.02mm that never needs finishing again