

Foiling Stained Glass

How To, Tips, & Tricks

The copper foil method, also called the Tiffany Method, of stained glass construction involves wrapping the edges of each piece in your project with a copper foil tape. The pieces are then joined by soldering them together on both front and back which creates a metal framework that holds the glass pieces together. Copper is chosen because it is easy to form and bend (is malleable), solders easily, and is readily available.

When Tiffany began using the method, workers used scissors to cut thin sheet copper into strips to the correct width needed to wrap the glass pieces. The strips were spread with molten beeswax on one side to make them sticky and then wrapped around the glass before the wax hardened. Today we have easy to use rolls of copper foil with the adhesive already applied. These rolls come in different thicknesses (mils) and assorted widths. You can also find copper sheets in various sizes with adhesive. But if you wanted, you could still use Tiffany's original beeswax on foil method.

All About Foil

Who makes copper foil for stained glass?

There are two primary suppliers of copper foil tape: Edco® and Venture Tape®. These are the brands you will see 99% of the time at your supplier. You may occasionally come across these other private label brands: Memory Copper Foil® (Ranger Industries), Studio Pro®, ArtEmboss® (AMACO) and Brighten®, which is a product made in China.



EDCO

Venture Tape

Ranger Industries

Diamond Tech

AMCO

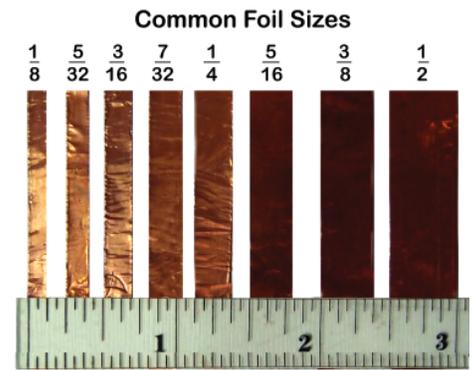
Brighten

Why do foils come in different widths?

The first and maybe most obvious reason is that glass comes in different thicknesses. Much of the stained glass today is production, uniform, and about 1/8" thick. If 1/8" is a "standard glass thickness" then 7/32" can be considered the "standard width" of copper foil; it provides for enough overlap on both sides of the glass to solder and hold the pieces together. There are also hand made glasses, semi-handmade glasses, and glasses with different textures, that are not uniform or "standard" thickness. Different widths gives you flexibility; on a thinner glass a narrow foil provides the needed amount of overlap without covering too much of the glass while on thicker glass a wider foil is needed to properly wrap them.

The second, and maybe less obvious reason, is you can use different foil widths to create different width solder lines. Your design may have lines, pieces or elements you want to accent or made less conspicuous. You can make wider or narrower solder lines by changing the width of the foil used to wrap the glass. Changing the amount of overlap is what determines the width of the solder seam joining your pieces together. Aesthetically, a basic rule is smaller pieces look better surrounded by narrow solder lines, larger pieces with wider lines.

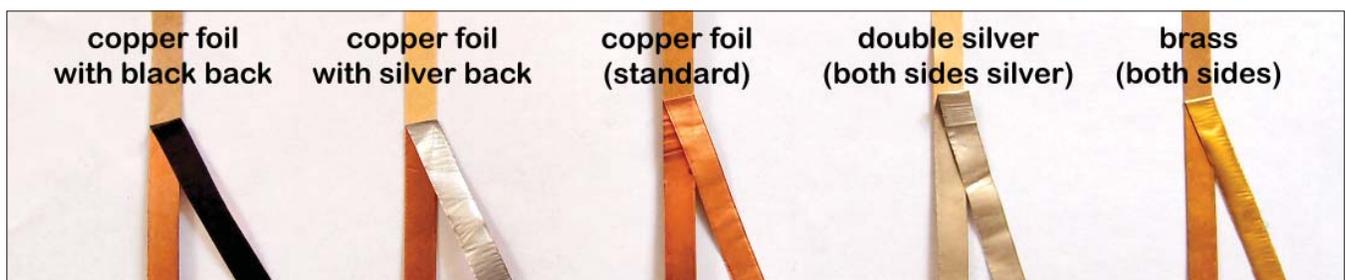
Widths of copper foil tape you will likely find are: 1/8", 5/32", 3/16", 7/32", 1/4", 5/16", 3/8", and 1/2". You may also find 6" and 12" widths but these are more likely to be in a sheet than on a roll. The guide below lists how these various widths are commonly used but remember that you can use any size you want: The only requirement is that the foil is wide enough to wrap the glass so you can solder it together - and that can be just barely coming over the edge!



- 1/8" is commonly used for glass nuggets so that you expose as much of the nugget surface as possible; wider foils can cover up a lot of the nugget making it almost disappear in the solder. It is also used with jewels, micro glass, glass slides, single strength glass and mirror, and other very thin glasses.
- 5/32" is used for glass nuggets, thinner glasses, jewels, micro glass, glass slides, single strength glass and mirror, or when you want a very narrow solder line.
- 3/16" is often used for beveled glass pieces, glass slides, single strength glass, jewels, and around smaller pieces or when you want a narrow seam on 1/8" thick glasses - it will just wrap the edges but you must be very accurate when applying.
- 7/32" is the most commonly used size and what most beginners start with. On most manufactured glasses made today it gives an overlap that results in an aesthetically pleasing solder seam for most projects. It can be used on thicker glasses to create a narrow solder seam.
- 1/4" gives you that little extra width for thicker and textured glasses. It is also useful when foiling two pieces of glass together to create a single piece (plating), to create a wider soldered seam or when attaching an overlay to a glass piece. It's an alternative choice for beginner foilers who find 7/32" too narrow.
- 5/16" is useful for thicker glasses, textured glasses, when plating pieces together, when attaching or creating an overlay, and if you want wider solder seams.
- 3/8" is useful for wrapping very thick glasses (like 1/4"), plating pieces, and for decorative effects.
- 1/2" is useful for very thick glass, plating thicker or multiple layers, and to create special effects or designs in seams or on glass pieces (as an overlay).

Why are there different colored backs?

Originally, copper tape was just copper colored, front and back. This was okay for opaque glasses where you couldn't see into the inside of the seams. On transparent glass or bevels you can look through the glass edge into the seam and see the back of the foil. This can look unsightly or distracting when back color doesn't match the solder's natural silver color or when a patina color other than copper is applied to the solder seams. Manufacturers introduced black and silver back foils to alleviate this problem. Now if you use clear or translucent glass and intend to apply a black patina you can use black back foil so the seams match the patina. If you are going to leave the solder silver, you would choose silver backed foil and if you are going to apply a copper patina, then use regular copper foil. There is a double silver tape, silvered on both sides, that is useful when you have seams or edges you are not soldering that you want to be silver or you want to avoid having to tin a piece foiled with copper tape to make it silver. Brass back foil is a specialty and used most often not soldered or when a piece made with clear glasses will be brass plated after soldering (there is no true brass color patina).



Why are there different thicknesses?

Copper foil tapes also come in different thicknesses, or mils. You will commonly find 1.0 mil, 1.25 mil, and 1.5 mil. Many users, and particularly beginners, find the thicker 1.5 mill tape easier to work with; it is less likely to tear as you wrap it around the glass. It is also less apt to stretch, curl, or wrinkle when you burnish it. The down side is that it can be more difficult to work into tighter curves without splitting; some find it more difficult to fold over, and on corners it can get bulky and difficult to burnish flat. The thinner 1.25 mil and 1.0 mill tapes can be easier to work into curves, bend, and are less bulky on corners but they can tear more easily and stretch more easily during burnishing. Some manufacturers wrap onto differently colored cores to identify the different thicknesses.



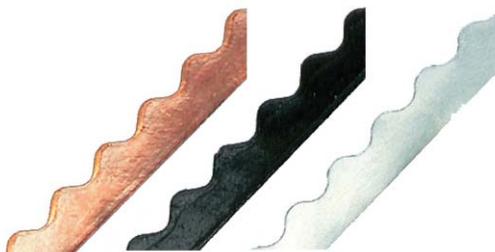
A common misconception is that using thicker foil makes your project stronger. Not so! Using a 1.5 mil foil does not make a piece stronger than one made with 1.0 mil. It is the process of soldering the piece, front and back along with properly wrapping and burnishing the foil to all your pieces that makes your piece strong. Which thickness to use comes down to what you find easiest to work with!

What is wave tape?

Wave foils, also called scallop edge, are copper foil tapes that are straight along one side and have a wave pattern or scalloped edge on the other. They are wider, about 5/16", and they too come with different colored backs. They are an easy way to add detail and interest to stained glass pieces; you can foil one side of a seam, both sides of a seam, offset the waves, have them line up, or use them as an overlay. They are applied so that the dips in the scallops on the top side of the glass cover or line up with the straight edge that would be wrapped around to the underside.



wave edge / scallop edge foils



Foiling How To

How do you apply foil?

The objective in foiling is to center the glass piece on the foil so that when you crimp (fold) the edges over the glass sides you end up with equal amounts of overlap, front and back. This process is repeated on every piece in the project. Most of us start out learning to foil using our hands but there are other options we will discuss later.

For the foil to adhere properly your glass pieces need to be clean and dry. Scoring can leave behind cutting oil residue while grinding, grozing, or using a scythe stone leaves behind grit. All these can prevent the foil from adhering. Make sure your hands are clean, dry, and free of any lotions, oils, and so forth for the same reason. Make sure to inspect your pieces for jagged edges and flares that could inadvertently slice a finger or the foil. (Though you should have found and removed them during the fitting process!)

Foiling is a three step process:

WRAPPING: Start by peeling back about an inch or so of the protective paper backing from the foil to expose the adhesive side. If you are right handed, hold the glass piece in your right hand by its edges. Use the fingers of your left hand to press the sticky side of the foil onto the glass edge as you look down on the piece, making sure it is centered on the glass edge. Some people start right at a corner, others start about ¼" before the corner (doesn't matter where you start on round pieces!). You then work your way around the glass using your right hand to hold and rotate the glass as your left hand's fingers go under the tape pressing it into the glass while your thumb helps peel the paper backing, making sure to stay centered as you go. When you have come around to your starting point, meet it or overlap slightly and then snip with scissors or tear off.

CRIMPING / FOLDING: The next step is to fold the foil over the edges onto the front and back sides of the glass - this is called crimping. With one hand rotating the glass, use the thumb and index fingers of the other hand; thumb on the front and index finger on the back to carefully fold and push the foil flat down against the front and back sides of the glass. When you come to corners, make sure you fold them neat and flat. As you fold, if you find places where the foil didn't wrap equally you can try lifting it away from the glass and re-center or just remove the bad section and re-foil. Fold all foil down all around the glass piece.

BURNISHING: The final step is to press and seal the tape firmly against both sides of the glass, removing any wrinkles, air bubbles and sealing it to the glass - this is called burnishing. There are many different tools used to do this but the goal is to have something hard enough to press with yet soft enough not to tear or stretch the foil as you rub and press the foil down. Some of your options are: Fids in various forms, your thumbnail, a popsicle stick, the barrel of Sharpie style marker or soft plastic pen, and tools specifically made for foiling.



Whatever you choose it needs to be comfortable to hold, rigid enough to help you press the foil firmly against the glass, but not so hard that it tears or stretches the foil out as you work. Usually a single run across the folded edges on both sides of the glass is enough to burnish it down. You need to avoid rubbing back and forth so much that you stretch the tape and cause puckers that could allow flux to seep under it. Besides burnishing the front and back sides, you may also want to burnish the glass edge although some feel that the pressure used when applying the tape initially is enough to seat it properly on the glass edge.

After burnishing if you notice that edges or overlap don't meet up even, or you went a bit off center on one side, use a good sharp blade in a craft (X-Acto® like) knife to trim things up. If you have a section really off, it is best to remove that section, re-foil, and burnish.

What about foiling tools & machines?



Jim's Nugget Foiler



KWC Table Foiler



There are many different hand tools and machines designed to help with some or all of the steps in the foiling process including applying foil evenly, automatically remove the backing, crimping, and burnishing. Some are hand held tools, others are machines that mount to a bench or sit on a work surface. They can be helpful to users with hand and /or finger problems, they can speed up some parts of the foiling process or make a particular step easier. See what tools your supplier carries as they often have demo models you can try. Talk to other hobbyists and ask their opinion but in the end remember: For all tools there is a learning curve - and that applies even to just using your hands!

Beyond Basic Foiling

What are overlays?

Overlays are metal (copper and brass generally) pieces placed over glass to create interest, special effects, detail, or add dimension. They can make a single piece of glass look like several pieces soldered together. They can create solder lines that look like they end in the middle of a glass piece. They can create detail that would be very difficult or time consuming to create using just glass pieces.



Because copper is soft and malleable (easy to shape) it is a good choice for creating overlays. You can use copper foil tapes, larger adhesive back copper sheets or thicker copper sheeting depending on what you are trying to create or achieve:

FOIL TAPE: You can take a piece of foil tape and apply it directly to the front of a glass piece and when soldered it will create a “solder line”. The process is the same as for foiling a piece of glass: apply the foil, burnish, trim if needed. You may want to match that line on the back side of the glass, depending on how the project will be viewed and the opacity of the glass. This is an easy way to make a single glass piece look like it is two or more pieces soldered together as in the wing veins picture above. It is also how to make a solder line look like it ends in a glass piece, like the baseball laces or bird beak shown above.

ADHESIVE BACK COPPER SHEET: Sheets provide the option to more easily cover an entire glass piece and create more intricate designs. Start by using the glass piece you are going to cover as a template and cut the shape from the sheet using scissors or a craft knife. Leave the backing on. Use a transfer method (like tracing) or draw a design directly onto the copper sheet. Cut out the places where the glass is to show using a sharp craft knife or scissors. Remove the backing and then apply the overlay and burnish to the glass surface. It is also possible to apply the sheet piece to the glass and then cut the design using a sharp craft knife. Care must be taken not to press so hard when cutting that you scratch or score the glass surface and cutting this way will dull the blade much more quickly.

You can choose to cover the entire glass piece at once by making the overlay large enough to wrap it over the glass edge and to the back. You can also cut the overlay to fit the glass face, apply the overlay, and then foil the glass piece as you would any other in the project. A third option is to foil the piece normally and

then apply the overlay making sure it meets or covers the foiled edge so that the solder will be able to join the two together. Choose the method that best works with your design, overlay material, and project.

Overlays from thinner sheet or foil tape may be more apt to warp or distort if you try to tin or solder them before attaching; it may be easiest to solder them during assembly. (Tinning is where a thin layer of solder is applied to the entire surface of a metal, often to make attachment or soldering an intricate design easier.) Use the minimal amount of flux needed when soldering overlays, especially on thinner overlays where too much can cause the adhesive to fail and the overlay to lift. Always be careful not to solder in one place too long to prevent heat fracturing the glass piece below or having the adhesive fail.

HEAVY GAUGE COPPER AND BRASS OVERLAYS: Heavier gauge overlays are usually pre-tinned if not given their beaded finish and then attached over the corresponding piece during assembly. There are two reasons for this: These thicker and heavier gauge brass and copper overlays are less apt to warp or distort when being tinned and they require more heat to build up in them (they act as a heat sink) before solder will adhere. Soldering them fully in place increases the chance the glass below can heat fracture.



3-DIMENSIONAL SHEET COPPER PIECES: Overlays and other 3-dimensional adornments can be fashioned from different thicknesses of copper sheet. This is pure copper that has been rolled to a specific gauge or mil (thickness). Cut using scissors, snips or similar tools and then manipulate into the desired shape. Because it is made from much thicker copper these pieces are usually tinned ahead of time, especially if they are 3-dimensional. Again, these overlays can be soldered and then either foiled to the glass piece or soldered in place during assembly.

What is mosaic tape?



This is a specialty tape product that lets you use clear and translucent glasses in a mosaic piece and avoid having the adhesive or grout color show through the glass, changing the color or making it look muddy. It has a highly reflective surface that bounces light back through the glass making it look like it has been mirrored or back-lit. It is available in aluminum with a silver reflection and has a high tack adhesive designed to be resistant to the heat created by curing cement and to stay bright in a cast projects which are often exposed to the weather.

What is plating?

Plating, also called layering, is a technique where glass pieces or a group of pieces are put over each other to create shadows, alter the glass color, create contour, create texture, add depth, or add more realism to a piece. It can be as simple as two glass pieces foiled together using a wide foil tape or a number of layers combined in a single piece or layer. Plating was invented in the 1880s and perfected in the windows and lamps created by Louis Comfort Tiffany (at right, Evening Landscape, 1910) and by John La Farge in the 1900s. It is usually done using the copper foil construction method. The technique is too involved to address here; if you are interested in learning more about plating there are tutorials, books, and patterns available.



Foiling Tips and Tricks

- Store opened packages of copper foil in a zipper type bag to help prevent oxidation and keep moisture from degrading the adhesive. Most foils will stay good for a year (sometimes more) when stored this way.
- Label stored foil with date purchased, width, and thickness. It's not always easy to tell 3/16" from 7/32"

- CD jewel cases can be adapted to hold copper foil rolls and keep them from unwinding. Place the foil roll inside and cut a small slot on the bottom to feed the foil through.
- If you have to put a project away when it's partially foiled, tape a small piece of foil to it so you know which size you were using when you come back to it.
- To avoid splits in the foil when foiling deep inside curves, start and end the foil at the deepest part of the curve, overlapping slightly. Use your finger to gently stretch and roll the foil over the edges. Another option is to stick a piece of foil as a patch on the glass at the inside curves deepest point, on both sides, wrap the piece, and then trim the extra foil off the patch with a craft knife.
- You can wrap your thumb and first two finger tips in cloth first aid tape to help protect them while foiling and crimping. Wrap each finger first with a piece going front to back over the tip of the finger, then another going from one side over the tip. Wrap a third piece around the finger that covers the first two to hold everything together.
- When foiling a lot of pieces, do the foiling first then go back to crimp all, and finally burnish all. Using a production line process saves time by allowing you to concentrate on a single step at time.
- On highly textured glass like ripple and herringbone, you may want to run the glass through an edge removing bit, like a RippleBit™, to make foiling easier. The bit produces an even edge around the piece for the foil and solder seam while maintaining the texture in the rest of the piece.  
- Another option for textured glasses like ripple and herringbone glass is to foil the piece so that you have at least 1/16" (~1mm) sticking up above the peaks. Use a wider tape and as you apply, keep the a uniform distance on the back side. Use a pair of small fine scissors to carefully cut into the valley areas, so that the top of the foil matches the curves and valleys as closely as possible as you maintain that 1/16" (~1mm) amount of foil above the glass - this is your overlap. Then crimp and burnish. 
- Foil drapery glass in a similar manner as outlined for ripple above. Use 1/2" wide tape and apply so that you have a uniform overlap on the back side, about 1/16" (~1mm). On the front side you may have places where the foil doesn't reach high enough to cover the folds; just apply another piece of foil so that it sticks up above and overlaps part of the first piece below. Use small, fine scissors to trim the foil to a uniform distance above the glass, following the hills and valleys of the glass. Crimp and burnish.
- You can use an old toothbrush to help burnish foil to textured glasses such as granite and ripple.
- Use an X-Acto® knife to trim unevenly foiled edges and correct unevenly folded foil instead of re-foiling.
- Warm, clean and dry glass foils easily; make sure to remove all grinding residue from your pieces before foiling and warm glass to room temperature.
- You can create your own decorative edged foils using the same craft pattern shears used to cut patterns in paper. Generally a wider tape, 3/8" or 1/2" inch works best, depending on glass thickness and pattern.
- You can combine copper foil and lead construction in the same piece to get detail in some areas and uniform lines in others.
- You can use different size foils in the same project. Thinner solder lines for smaller pieces or more detailed areas and wider for larger pieces.
- If you are going to have a finished foil edge on your piece (like on a suncatcher) you might want to use a slightly wider foil for the outside edge and then bead up the front, back and edge for a more finished look.