

Wood Works



David Marks, host of the television program *Wood Works* on the DIY network, discusses the advantages of urea formaldehyde (plastic resin) glues. One useful application is when working with bent laminations, such as this Koa contemporary lamp.

Safety Alert: Urea formaldehyde glues have been classified as a possible human carcinogen. Always wear protective gloves and ensure adequate ventilation, when working with this glue. Also, read the safety instructions that come with your glue.



David Mark's cable television series *Wood Works* is shown on the *DIY Network*, currently every Saturday evening at 6:30 pm and 10:30pm (Pacific time). Episodes (2 per week) are also available on the web site www.diynetwork.com/diy/shows_www/.

Some projects mentioned in this article are discussed in the *Wood Works* series: *Koa Contemporary Bent Laminated Lamp* (Episode 512); *Mahogany Head Board* (Episode 405); and *Mahogany Bent-Laminate Shelf Stand* (Episode 401).

David will be on the road, teaching workshops through the Fall. In early September, he will be conducting his *Gilding & Chemical Patination Workshop* in Hawaii (the Big Island, Oahu, and Maui), while at the end of September, he will be teaching at the Marc Adams School in North Franklin, IN. He also will be demonstrating at the *SWAT Woodturning Symposium* in Wichita Falls, TX, Oct. 6-7, and in early November, he will be leading workshops at the five Woodcraft stores in Texas. Details on these classes can be found at his web site: www.djmarks.com.

Working with Urea Formaldehyde Glues

by David J. Marks

In a recent issue of *Fine Woodworking* magazine (July-August, 2007), they tested the strength of six types of glue "most commonly used for furniture making." Among the glue types missing from this report were slow setting urea formaldehyde (plastic resin) glues. These are glues that I use primarily for bent laminations and veneer work, although there are times when I get into some challenging assemblies that I find these glues to be the answer.

Urea formaldehyde glues have several qualities that make them superior to all other glues:

1. Long open working time (30-45 minutes in cooler weather.
2. These are rigid glues that will not creep over time.
3. Gap filling ability, which means that they will work when uniform clamping pressure is difficult.
4. Resistance to moisture, solvents, finishes, etc.
5. An ability to glue oily woods (such as a number of exotic woods).

Most important is that these are "rigid" glues. For bent laminations and veneer work (as well as general joinery), the wood will stay where you put it, and the glue lines won't cold creep or open up. This is a big deal when you compare it to PVA glues, also known as yellow glues. Yellow glues are very, very strong, as was evidenced in the *Fine Woodworking* article, but they are semi-rigid. Over time, woods that are under stress can exert some force or pull on the glue lines, causing them to expand. I have seen meticulously crafted pieces of furniture glued exclusively with yellow glue, which later exhibited joints that have pulled open. Veneer, either commercially cut at $1/32$ " or band sawn veneer cut to $3/32$ ", still can exert enough force on a glue line to cause it to open over a period of time.

One of the demonstrations that I do for a lot of the classes that I teach is to show students two dried glue films. One is some yellow glue that I have poured out onto a piece of plastic, and the other is some urea formaldehyde glue. Both of these glues were left to cure for a week or more, so that they could reach maximum hardness. In the demonstration, I put the sample of yellow glue in one hand, and the sample of urea glue in the other hand. I tell the students that, as I speak, the warmth from my hands will warm the dried film of glue. The reason that this is important is that once a piece of furniture is built and placed in a home environment, there is a distinct possibility that it might be located

near a window and exposed to direct sunlight. It does not take much heat before the yellow glue becomes flexible. After a minute or two, I remove the films from my hand and show that the yellow glue has become flexible enough that it can become twisted into a knot. While trying to bend the urea resin glue, people can see that it is so rigid that it snaps in half.

I did not discover these glues by accident. I have searched out information on glues for over three decades. I learned about bentwood laminations around 1982 from world-renowned sculptor **Michael Cooper** who lives in Sebastopol, CA (about 15 minutes from my shop here in Santa Rosa). Michael is famous for making amazing sculptures of motorcycles and guns completely out of wood (see page 15). Michael has been using the DAP Weldwood plastic resin glue for decades with great success. The DAP product is a pre-catalyzed powder that is mixed with water. I find this works great for bent laminations, because the water helps to soften the fibers of the wood and increases its flexibility.

Several other sources of information that I have drawn from over the years are *A Manual of Veneering* by **Paul Villiard** and articles written by **Tage Frid** and **Jere Osgood** on bentwood lamination in *Fine Woodworking* magazine. All of these authors are experts and discuss the advantages of using urea formaldehyde glues for veneer work, as well as for bentwood laminated work.

Other advantages of urea formaldehyde glues are their long open working time, gap filling ability, resistance to moisture and solvents, and an ability to glue oily woods. When working with veneers, it is helpful to work with a slow setting adhesive as you are lining-up pieces in place, especially for grain matching, inlay, and marquetry. Also, gaps between veneered pieces can be easily filled, the veneers are not likely to separate in everyday abuse (such as spilled liquids on tables), and these glues can be utilized with a variety of exotic materials. In addition, the wet glue softens the fibers of the wood and makes the strips more pliable.

For other complex assemblies—such as casework proj-

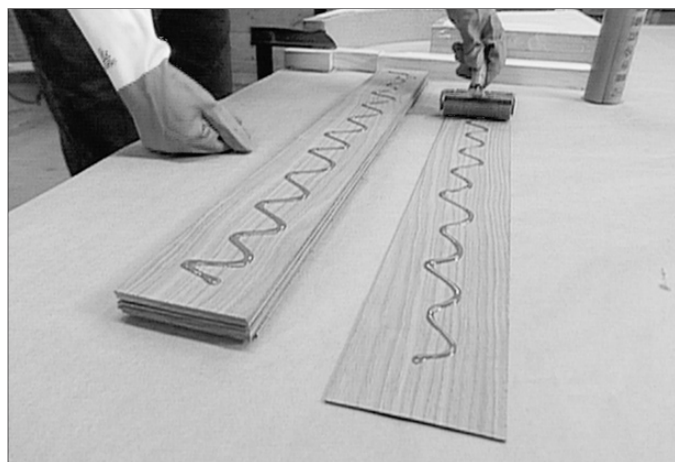


Figure 1. For lamination, squeeze a zig-zag stream of glue on both surfaces and use a rubber roller to evenly spread the glue.

ects (desks, buffets, large cabinets) and complex joinery (any situation in which you might need half an hour to apply the glue, assemble it, and get the clamps on)—the long working time is advantageous because it spares you the potential of rushing and making mistakes.

To apply glue for laminations, I like to use a plastic glue bottle to dispense the glue. I squeeze a zig-zag stream along the length of the pieces to be laminated and use a rubber roller to evenly spread the glue (Figure 1).

When attaching $1/32$ " veneer to a substrate, I recommend applying the resin glue only to the substrate, and not to the veneer, because applying glue to the thin veneers would cause them to curl and make them difficult to set in place. This scenario is different from thicker veneers, such as $3/32$ " veneers, and for joinery. In these cases, I like to put glue on both of the surfaces to be joined together to ensure that the glue has wet the fibers of the wood, preventing a starved glue joint.

To compensate in the situation of thin veneers in which glue is applied to only one side, I put a heavier application of glue on to the substrate (Figure 2). With the glue applied to the substrate, I carefully set the veneer in place (Figure 3), then flip the panel over to repeat the process

Figure 2. To glue $1/32$ " veneer to a substrate, spread glue only on the substrate.



Figure 3. With glue applied, carefully place the veneer on the substrate.



Figure 4. With veneer attached to both sides, tape the "wood/glue" sandwich.



for veneering the other side. By taping the lamination into a “wood-and-glue sandwich” (Figure 4), the pieces are secured from slipping before placing in a vacuum bag or veneer press for curing. In this example, the final product is a beautiful *Mahogany Head Board* (Figure 5).

There are the four types of urea formaldehyde glue that I use:

1. **Urac 185**, manufactured by the American Cyanamid Company. It is available in retail quantities from Highland Woodworking (www.highlandwoodworking.com) and Nelson Paint Company (www.nelsonpaint.com). Also, some of the Woodcraft stores have begun to stock this glue.
2. **Unibond 800**, which is available through Vacuum Pressing Systems, Inc. (www.vacupress.com).
3. **Weldwood Plastic Resin Glue**, made by DAP and available at most hardware stores, especially at ACE Hardware stores.
- 4) **Resorcinol Glue**, generally used on boats because it's completely waterproof when cured. It does, however, leave a dark glue line, which would be objectionable on light colored woods. Resorcinol is difficult to find, but can be ordered through ACE Hardware.

In 1984, I made a desk out of Ipe, an exotic hardwood from Brazil, and used Ipe again for a lamp table commission in 1985. Both times, I used Resorcinol urea resin glue to bond the wood, and both pieces have maintained their structural integrity for over more than 20 years.

In 2006, I undertook a job with my friend **Bob Koch**, to construct a 60-foot deck rail (Figure 6). I needed to laminate two pieces of 1½" thick Ipe together to make posts that measured 3" thick by 5" wide. I was confident in the use of Resorcinol to laminate the wood, but I did my own test of glues for outdoor application. I found that the only glue that held up to the weather on Ipe was Resorcinol. An additional note, I sealed all of the end



Figure 5. Mahogany Head Board with veneered panels.

grain of the posts top and bottom with Smith's Tropical Epoxy, which I sanded smooth after it cured.

In conclusion, I would like to mention that these glues are heat sensitive in terms of the open time and curing time. In other words, if you are working in a cold environment, 60° or lower, the glue won't set up and your working time will be extended. It is easy enough to tarp the project with some 1 mil plastic and put a small ceramic heater in there to bring the temperature up to 75° or 80° to accelerate the cure time. If on the other hand you live in a very hot climate (like my friends in Texas and Arizona), then exercise caution, because at higher temperatures like 90°, your working time (assembly time) could be reduced to 5 or 10 minutes.

*Bent-Laminated
Shelf Stand
Mahogany*



Figure 6. David inspecting a 60-foot deck rail made of Ipe, using Resorcinol urea resin glue.

