

# GLUE-THE PVAs

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In the last issue I included a rather extensive rundown on Cyano Acrylics. I had previously given the history of Ambroid and some hints about using it in the MAY-JUN 2012 issue of MaxFax (also in the May 2013 Issue of this rag). To reiterate, Ambroid (or Duco for that matter) is a solvent based glue. The best joints are made by "double glueing" the joints. Start applying a layer of Ambroid to both sides of the joint. This application of glue soaks into the wood fibers and is allowed to dry. When you make the joint, apply a second layer to one side and stick the two sides together. The solvents will partially dissolve the glue that is in the wood and form a bond. Ambroid and other solvent based cements are more flexible than Cyano.

This time we will look at the other major choice for assembling models: polyvinyl acetate (PVA), also known as "white glue". PVAs are non-toxic and very easy to use, but hard to repair since nothing else sticks well to the hardened glue. (Ambroid will stick to Cyano.) Remember you have two distinct adhesive systems here that are not compatible. Get dried PVA glue on balsa and Cyano and Ambroid won't stick to it. Likewise a coat of Cyano or Ambroid will keep a PVA glue from adhering.

Aliphatic resin glue is chemically similar to PVA (white glue), but it is chemically modified to make it stronger and more waterproof. It is typically a buttery yellow color and is sold as "carpenter's wood glue." TiteBond II is what I use. It has an open time of 5 minutes and takes about 15-30 minutes to set and it sands reasonably well, although it does sometimes gum-up the sandpaper if you use too much. The fast set of an aliphatic resin glue makes it better than a standard PVA type white wood glue, giving a stronger bond, faster, while allowing easy clean up of spilled aliphatic adhesive with a damp cloth before it dries. What about TiteBond III and the "original" TiteBond? TiteBond III has been modified to be more water resistant --almost water proof. It has a longer open time of 10 minutes and therefore a longer set time. It's not quite as tacky as TiteBond II and leaves a dark glue line. I wouldn't use it except for seaplane hulls. The "original" TiteBond appears to be a straight PVA with less tack and water resistance than TiteBond II.

TiteBond II is stronger than Ambroid. A good TiteBond II joint is stronger than most woods: orders of magnitude stronger than balsa. Ambroid is a little stronger than balsa and fine if that's all you are gluing. For spruce, bass wood, and plywood TiteBond II is a better bet. Working with Ambroid and TiteBond II (or other aliphatic resin glues) is different. Although some of the techniques from Ambroid can be used. TiteBond II is water based and it really only requires a thin layer. The double glueing trick works with TiteBond II. Make the initial application of glue to both pieces to be bonded, wipe off all the excess and let it set for about 5 minutes. Then apply a very thin layer to one part- it will grab almost instantly. Give the joint about 5 minutes and you can file it. Don't stress it for 30 minutes or more. Maximum strength requires several hours. TiteBond II also shrinks as it cures. On a properly made joint, the shrinkage can actually pull the joint tighter.

I use three methods to apply TiteBond II. I put a little pool on a plastic lid and dip the end of a balsa strip into it before a sticking it in place. I may also apply TiteBond II with a tooth pick dipped in the pool. I fill a hypodermic syringe that has a 0.032 i.d. tip with TiteBond II. I use this as I would my squeeze bottle of thinned Ambroid. I also have a plastic 35 mm film can filled with TiteBond II thinned with water. I use this with a brush or Q tip for filleting and applying tissue.

Ambroid joints can easily be undone with MEK or acetone. One good reason for using it. After it cures, TiteBond II is water resistant and can't be readily debonded with water. Solvents won't phase it. TiteBond II is also thermo plastic and can be heat bonded. You can put a layer on the edge of the ribs, and a layer on the sheeting opposite the ribs. Then just put the sheeting on and heat it with an iron. TiteBond II will polymerize and bond the sheeting to the ribs. You can also loosen a TiteBond II joint by the application of heat.

Another variation of aliphatic resin glue, the Super Phatic brand, is marketed by Horizon and Balsa Products. It is a thinner, highly penetrating aliphatic that has the same properties as the standard aliphatic resin glue, but is water thin and penetrates with a "wicking" action for close fitting pre-assembled joints like a thin Cyano. However it takes 10 minutes to bond rather than 10 seconds. It is waterproof when set and produces tougher (more flexible) joints than cyano. It also has some of the drawbacks of thin Cyano. Get too much on a joint and you get a flash of dried glue that's the very devil to sand off. If the joint isn't tight fitting, you get a lousy joint. It does have a shelf life; eventually, it will turn brownish, and become slow to set. I just used some dated 2005 and it worked fine. That being said, if you build tight structures and are allergic to the fumes from Cyano, it may be what you want. Just remember, once you use it you are committed to PVA assembly.

The next PVA type adhesive I would like to mention is Weldbond. It's a little different. The manufacturer, Frank T. Ross & Sons Ltd is a little cagey about what it is chemically and merely says Weldbond is a PVA (Poly Vinyl Acetate based adhesive). My guess is that is not an aliphatic resin emulsion. It's white and has some unique properties. For instance the manufacture states: "Weldbond can quickly be dissolved with acetone. Because Weldbond is water based it can also be dissolved with a soaking of, or submersion in water. This will dissolve a bond." I tied it and acetone works! Not speedily like a solvent based cement, but eventually. "The set up time for tackiness will vary with humidity, but is roughly five minutes for most projects. It will be somewhat longer in humid conditions. Weldbond becomes tacky quickly and will dry within the hour on porous surfaces. It provides a strong bond within 24 hours and full strength within a few days. Most bonds can be made without the need of clamping, unless working with materials that are bent or warped. It dries transparent. Glue joints will practically disappear and any excess material can be wiped up with a damp cloth up to 20 minutes after application. Weldbond provides a flexible bond. Joints can be made on flexible materials without the danger of cracking or breaking when a project is moved. A sealing mixture of 5 parts water to 1 part concentrated Weldbond dries in approximately 1 hour, and can be used to increase the flexibility and strength of porous and soft wood, such as balsa. The wood is much less likely to split, particularly when it is being shaped. Two coats of the sealing

mixture can be used, if necessary. This adds negligible weight to the balsa and when dry, makes an excellent primer." (Ed. Note: Sounds like a candidate for wooden props.)

What the manufacturer didn't say is liquid Weldbond can be dissolved in Ammonia(or Windex). (TiteBond II, by contrast, will curdle in ammonia.) Why would you want to do that? Well ammonia softens the lignin in wood. This is a great aid in laminating outlines. Years ago, I was tipped off to the fact that by brushing thin strips of balsa or bass wood with a 60/40 mixture of ammonia and Weldbond, they will become much more flexible. You only need to soak it for a few minutes, before you stack up the laminate strips. Then squeegee off the excess glue with a paper towel and pull it around a waxed form always keeping the stack in tension. I use masking tape to hold it to the form. It will usually cure within the hour to the point it can be removed from the form. It continues to develop strength overnight. A microwave can speed up the process, but may transfer too much wax from the form to the lamination making it hard to glue to. Despite the laminating being done with a "PVA type" glue, the finished piece can be glued to the next assembly with Ambroid or Cyano as well as white glues. I keep a 35 mm film can filled with the Weldbond-Windex mixture ready for quick laminating. I'll confess I don't use Weldbond for much else, but this feature alone is worth the effort. I do find the 5: 1 ratio sealing mixture an excellent alternative to sanding sealer for nose blocks etc and it works on foam. TrueValue and Ace hardware stores carry Weld bond.

Finally there is Canopy Glue which used to be known as Wilhold RC 56. The Material Safety Data sheet defines it as Vinyl acetate polymer emulsions in water. Pacer calls it FORMULA 560. JZ Products, calls it Super Z RC 56 GLUE. It offers exceptional bonding of most all plastic and vinyl. It dries clear making it the glue of choice to use for attaching airplane canopies and vacuum formed ABS parts. When using it to attach a canopy or wind screen, trim the parts to as close a fit as possible. The glue will migrate under small cracks forming a complete seal and a very tight bond, the smaller the gaps the better the bond. You will need to clamp or tape the parts together for several hours until the glue starts to turn clear, full strength takes about 24 hours. Temperature and humidity will effect the drying times. If you coat both sides of the joint and let them dry for 5 to 10 minutes until it starts to turn clear, it will act as a contact cement. Press the coated surfaces together and they will grab eliminating the need to clamp for hours. It will still take time for the bond to gain full strength. It turns out that RC-56 type glues are also thermo-setting. A MonoCoat iron will activate a dried glue line if you wait too long to get them to grab. Just make sure you are below the melting point of the plastic being used.

Below are pictured the four basic types of glues discussed in this article. A syringe with a 1/32id tip works nicely to dispense full strength TITEBOND II. (White glue does not attack the rubber plunger like solvent based glues to) A T-pin proves to be a convenient stopper.

A red (24 gauge) teflon tip from Mercury Adhesives fits nicely on a Super-phatic bottle. A common pin about .020 OD serves as a stopper.

