

# ALL ABOUT GLUE

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Way back in the dark ages, the glue of choice was Ambroid, a cellulose-based glue. Believe it or not, it still has its uses today. One great thing about Ambroid is that it sands well, so it could be used in laminations, as long as the final shape will be fibreglassed.

However, what we are going to discuss here are the more commonly used glues: CyanoAcrylate (CA), epoxy, SuperPhatic, aliphatic resins, and Gorilla Glue.

In the beginning, there was Hot Stuff – this was the first glue I learned to stick my fingers together with . . . It was made by Satellite City (or distributed by them) and introduced the fast build era we live in today (unless you are me – it does not matter what glue I use I am slow). Initially, all we had was thin Hot Stuff, and then they introduced medium and thick varieties. We had a representative from ZAP show up at our club and to a demonstration once – quite interesting.

CA works best when you have a tight fitting joint, so take a couple minutes extra and cut that angle precisely. Sometimes you just can't get it right, and that is when you use medium or thick. Of course, both medium and thick take longer to "kick" and the parts must be either held or clamped in place. Medium and thick are (in my opinion) best used in balsa to ply or hardwood joints. (Even better here would be epoxy – more later.) On occasion, you may want to "pre-glue" the joints – apply a drop or two on each piece, let them kick, then join them and re-glue.

Moisture will make CA turn – medium gets thick, thick gets rigid and thin gets gooey. If you live in a humid climate, try to keep your CA in a jar with a desiccant. A friend of mine has a small refrigerator in his shop – he keeps his CA in sealed containers in the fridge. He keeps his LiPos in there too. To extend the shelf life of your unopened CA, keep it in the refrigerator – just make sure your wife knows not to use it as a condiment.

Be careful using CA kicker – make sure the spray is not directed anywhere near your opened container of CA. I like the pressurized spray can the best, the bottled "pump" type always seems to me to spit rather than spray – and you only need a very light mist to make the CA kick. Be aware, that using kicker on medium and thick CA will often cure only the outer surface – you still need to hold the parts for several seconds to get full cure. If it turns white, you have over done it.

There are several types of CA now: thin, thick, medium, foam safe, "gel" and "sheet zap" which is really slow to cure.

When gluing hardwoods (spruce and bass, etc.) it is sometimes handy to "woodpecker" the joints – take a pin and puncture the surfaces where you will be gluing.

The fumes given off by CA when it cures rapidly can really affect you – many people become allergic to CA. Try to arrange a small fan blowing from behind your shoulder if you are doing a lot of gluing, or at least arranged in such a way as to blow any possible fumes away from your face.

CA applicators: There are a few different kinds of applicators, Z-Ends and Z-Extenders are probably typical of what most people use. Our buddy Don Rice (drice) keeps a small jar of

acetone handy – when one of the Z-Ends gets clogged, he pulls it off and tosses it in the acetone, taking a clean one from the jar. You can also use pipettes like these: <http://www.carolina.com/product/equipment+and+supplies/measuring+equipment/pipets/microchemistry+pipets%2C+micro-tip%2C+overall+length+5+3-4%22%2C+capacity+5.0+ml%2C+pack+100.do?sortby=ourPicks> or you can use a PTFE 18-gauge tubing – here are a couple of sources: <http://www.westfloridacomponents.com/TF027/18+AWG+Gauge+Teflon+Tubing+TFE.html> (thanks to John Eberle) or <http://www.amazon.com/Zeus-Teflon-Gauge-Length-Spool/dp/B000FMWUWO>

Epoxy is a two-part resin and is anaerobic, meaning it does not need air to cure. If you read the bottles, one usually says “hardener” – this is the catalyst that causes the chemical reaction. Epoxy for glue is usually mixed 1:1, while finishing resins are mixed 1:4 or 1:5 or some other ratio. Finishing resins should not be used for glue. Note that West Systems epoxy, TAP 4-1 Epoxy and Zap Finishing Epoxy are NOT glues, they are finishing resins. They are not formulated for strength per se, but for their finishing characteristics.

Epoxies are classed as 5-minute, 6-minute, 30-minute and 45-minute. You should have one of each of the “fast” and “slow” cures in your shop. The actual mixed ratio is not highly critical, but should be mixed as closely to the specified ratio as possible. If the ratio is off enough it can really change the cure time and final strength. Gordon Banks of RC Report did a test a few years ago where he deliberately mixed up several batches improperly. In all cases the epoxy finally cured, and final strength was somewhat compromised – so mix as accurately as you can.

“Quick” cure epoxy is used where a high strength is not necessarily needed – joining wing panels for instance (because the joint is later fiberglassed). Slow cure is used for things like firewall to fuselage joints. Also note that while they cure in the specified time, full cure can take hours.

Do not thin epoxy to be used as glue with alcohol – this does reduce strength. You can mix in micro-balloons or Cabosil as fillers – this makes the epoxy stiff and less runny, so it will stay in place. Cabosil filled epoxy is harder to sand than micro-balloon filled epoxy. Years ago, Sears sold a “filled epoxy” in a squeeze tube (like a toothpaste tube). This was good stuff, it would stay where you put it and sanded well. Have not seen any for a long time, but you never know if you will run across it again.

SuperPhatic and Aliphatic resins. Best known in the US as Titebond – Titebond is an aliphatic resin and Titebond II is a polyvinyl acetate. Both are good for our use. I have used both to join wing sheeting together and to glue wing skins to the ribs, or sheeting to the fuselage. No special precautions with either are necessary, just clean your hands after using and keep it out of your eyes.

Like epoxy, titebond takes clamping and patience. You have a few minutes working time, so you can coat several pieces and then start clamping or pinning them in place. Don't try to do too many at once, and after clamping let them set for several hours. This would be good glue to use for sheeting in the morning before leaving for work. It would be cured enough to handle by the time you get home.

Titebond is water-based, and they say on their tips sheet that you should wait several days for the water to evaporate and the wood swelling to go back to normal before you plane or sand it.

SuperPhatic (SP) is a variety of aliphatic resin that has been reduced (I am told by denatured alcohol) to a water-like consistency. SP is good for strip planking and some sheeting. It tends to cure fairly quickly depending on your environment. It is supplied with a tube dispenser – be sure and clean it out at the end of a session! Ask me how I know . . .

Pin your parts in place, add a couple drops of SP and move on to the next one. If you are using it for strip planking, do a strip on one side, go to the other side and add a plank, by the time you get back to the first side you can usually remove the pins and do the next strip. (You want to alternate sides when strip planking anyway – helps keep the bow out.) I have not had much luck gluing balsa stringers to ply or lite-ply formers – it may be my technique. Worth testing on your own to see what you come up with.

Gorilla glue is a fairly recent arrival. It is a urethane prepolymer with polymeric MDI. Got that from the MSDS at Gorillatough.com and I have absolutely no idea what it means, but it sounds good. It is mildly toxic to breathe, do not ingest it; if you get it on your clothes, take them off ASAP (like right now) and use a hand cleaner based on polyethylene glycol or plenty of soap and water. It would be a good idea to wear gloves when using this stuff.

I personally am not a fan of this glue, but it is very effective and some people really like it. I have used it to sheet foam wings – it is very effective for that. You HAVE to clamp your parts, and you HAVE to clamp them securely so they will not move. This glue foams up somewhat as it cures and it can push your parts apart. When sheeting foam wings with it, you spread it out on either the sheeting or the foam core, give a light mist of water to the other part, join them and start piling weights on. Make sure you have a lot of weight. Then add some more. Ask me how I know THAT too . . .

According to their website, it requires 20-30 minutes of clamp time and fully cures in 24 hours

They also have a Gorilla Wood Glue which does not expand as much and is for use on wood only. You still need to clamp for 20-30 minutes, is 80% cured in 1-2 hours. The website says both glues are sandable, but my limited experience with the other one indicates that it is not, or at least not very.

Test pieces for any glue and situation are always advisable. Set up tests so that you can test several types of joints to see how they fail, then choose the glue for the situation. Think I might do that when I have some time.

The following is from drice's (Don Rice) Zirolli Corsair thread, referring to Gorilla Glue:

*Tom, I love gorilla glue. Many guys use slow-zap where I would use gorilla glue because a) they are faster, more confident, and more skilled, than I am, and b) I am more patient than they probably are.*

*I really like it for the sheeting process. The gorilla glue definitely has plenty of working time for me to get it spread on all the ribs, spars, stringers, whatever, which generally takes less than 5 minutes. Occasionally, the 1st parts I apply it to, might start to bubble slightly, but it's still plenty liquid enough for me to get the sheeting fitted. I'd say you have at least 15 minutes to get it applied and to start the lay-down of your sheeting. The minor bubbling that might start doesn't mean anything. I then take my time and get all the clamps, pins, lead weights, stacks of*

*magazines, dancing girls & liquor bottles, etc in place, and walk away for a couple hours...or days.*

*It is very sandable. Far more so than epoxy and zap.*

*I'm talking about the honey colored original gorilla glue, not the new clear stuff. It is less strong, bubbles up a good 50% more, and is at least 50% faster than the original. I love it too, but I use it for things where strength isn't really an issue*

So there you have it. The beginners guide to glue, and when to use what. Most of it comes down to experience and preference (and trial and error). Speaking of preference – I prefer the Bob Smith CA because it has a screw on cap which makes the use of the pipettes easy. As usual, your mileage may vary. Not an endorsement for BSI (but it IS an endorsement for screw-on caps!).