



# Stuck like glue

*Never leave kicker spray alongside cyano, the kicker's vapour can cross-contaminate and shorten the glue's useful life.*

*Squeezing the bottle as you pick it up, then holding the 'squeeze' during application, will help to stop the tip from clogging.*

JOHN BRISTOW ADDS A LITTLE MEAT TO OUR KNOWLEDGE OF THE AEROMODELLER'S FAVOURITE ADHESIVE – CYANO

**S**ince its introduction into the modelling market, cyanoacrylate (a.k.a. cyano, or ca) has become one of the most versatile adhesives for the aeromodeller. In common with many areas of our hobby there continue to be technological advances with cyano, too, and not just with regard to the adhesive itself; containers, applicators, fillers and setting agents that improve performance and versatility are all subject to continued

development. In this article we'll take a look at such advances as well as some practical tips that you might find useful when using cyano. But where did it all begin?

## GENESIS

Cyanoacrylates were discovered in 1942 when a team of scientists were searching for materials to make clear plastic gun sights. They stumbled upon a formulation that stuck to everything with which it came into contact, but it was rejected for the application and shelved. Some years later Eastman Kodak researchers Harry Coover Jr. and Fred Joyner, recognising the potential of cyanoacrylate, brought the first commercial example to market, and in 1958, 'Eastman 910' became the first cyano to be sold.

Eastman Kodak sold cyano to other companies during the 1960s, but this monopoly eventually disappeared as other manufacturers arrived on the scene and new companies began to manufacture (or repack) similar products. Today, cyanos are produced



globally in a variety of viscosity grades – thin to thick – to cater for all manner of joint bonding.

## LIMITATIONS

Whilst undeniably strong, cyanos are very brittle and not suitable where impact resistance is required, although rubber-toughened cyanoacrylates have been developed



**TOP LEFT:** Applications where there's constant exposure to moisture should be avoided, so using cyano here is not advised.

EPO foam isn't a problem for most cyanos but painted surfaces will inhibit adhesion.

to improve this limitation. Similarly, cyano isn't suitable when bonding materials with significantly different thermal expansion coefficients, such as a glass-to-metal joint. An example might be bonding a metal rear view mirror to a windscreen, which is likely to result in catastrophic failure. Applications where there's constant exposure to moisture should also be avoided, as water will eventually break down the joint.

Most companies specify a 12-month shelf life for cyano, although from a practical perspective this is dependent on type, grade and storage conditions.

## STRENGTH AND CURE

In contradiction to common understanding, cyano should be allowed to cure for at least 24 hours (heating the bond will increase its strength), since the slower the cure speed, the higher the bond strength. If the adhesive bonds too rapidly it can trap uncured cyano, which will reduce the strength of the joint.

It's very difficult to slow the setting process of cyanoacrylates, so by far the best option is to obtain the most appropriate grade for your application.

## TEMPERATURE

Cyanoacrylate glue joints slowly degrade at high temperatures, so don't expect bonds to perform well above 180°C.

## STORAGE

Cyano is best stored in a cool, dry room at 5–10°C, away from daylight. Every 10° increase in temperature doubles the deterioration speed; storing unopened bottles in a refrigerator, therefore, extends life, but allow any bottles thus stored to return to room temperature before use. Once open, keep cyano in a cool, dry place away from daylight. Be sure to replace the cap on the bottle immediately after use or, if

you wish, leave a purpose-made micro tip on top. In this latter case the glue will cure at the tip where it's in contact with moisture in the atmosphere and will thus seal the bottle ready for next time. Note that both heat and moisture shorten life.

Finally, don't store your cyano bottle next to a bottle of activator, since fumes from the activator could cross-contaminate and also shorten its useful life.

## PRACTICAL TIPS

### Prevent sneezing and eye irritation

– Choose a non-fuming, low odour grade of cyano, or try placing a saucer of water close to where you're working.

**Reduce tip clogging** – Squeeze the bottle gently as you pick it up. Hold the squeeze, apply the glue, return the bottle to upright and release the squeeze. Oval bottles are easier to squeeze and specially-made micro tips help to dispense the glue where you want it. Using a metal pin to keep the tip clear may have a negative effect by curing the glue around it.



**Blooming on clear plastics** – Blooming is caused when cyano doesn't fully set and the remaining glue vapourises. This vapour can then react with the moisture present on the clear plastic surface (usually a brand new canopy!) and spoil it. You can reduce this effect in several ways:

- Warm clear plastic surfaces to eradicate moisture.
- Use less cyano.
- Use a non-blooming grade.
- Use an accelerator spray.

*De-bonders are great for removing surface marks from a variety of materials.*



*Cyanoes need help with shiny surfaces and this is where a good primer can be invaluable.*

Powders such as this can help fill and strengthen gaps when used in conjunction with thin cyano.



Special micro tips and fine nozzles help direct the glue exactly where it's needed.

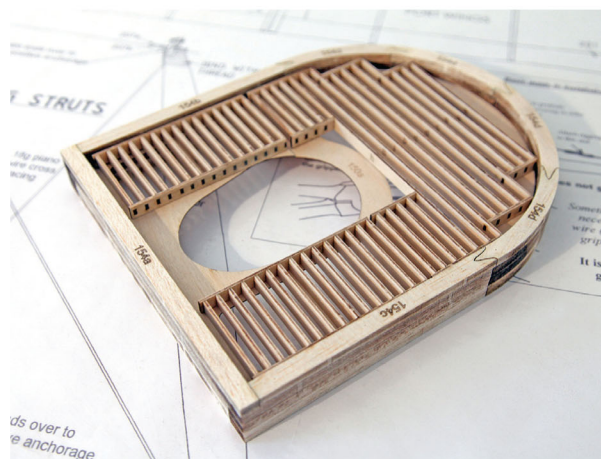


**Stop caps getting jammed** – Apply Teflon tape around the thread on the neck. Alternatively, note that spare caps and plugs are available from some manufacturers should you be unlucky enough to jam one.

**Cyano accelerators (kickers)** – Use only when needed, as these tend to slightly reduce bond strength. Avoid breathing the vapour and bear in mind that on pump dispensers you can remove the spray head and apply kicker with a brush.

**Using cyano with white glue** – Obtain the combined benefits of cyano and PVA by using cyano to tack the joint in place whilst reinforcing it with PVA. Some manufacturers make

Cyano use has promoted a new method for building laser-cut kits: interlock the parts first, then run glue into the joints.



## THE APPLIANCE OF SCIENCE

The reason that cyano is so good at producing a strong, quick bond is down to its chemistry. Cyano cures by a process of rapid polymerisation. This conversion – from a liquid to a solid – is triggered by moisture or any basic contamination on the surfaces to be bonded. The equation for the setting (polymerisation) of a methyl cyano is set out in Figure 1.

In total only 5 – 6 cyanoacrylate monomers are commercially available and they are outlined in the structure shown in Fig.1. The most common type of cyanoacrylate is the ethyl-2-cyanoacrylate type that's found in most products. However, for more specialist applications other cyanoacrylate monomers have been developed. The major difference between each type is in the ester group (e.g. methyl, ethyl), denoted by 'R' in Figure 2.

The larger the size of the ester group (R) the slower the cure speed, and the lower the bond strength. The higher analogues have found special use in the medical industry as tissue adhesives.

One of the main ways in which an adhesive works is by mechanical 'hooking', i.e. it must flow well onto and into all of the microscopic cavities on a surface, and cyanos bond especially well in this respect, attaching to most surfaces extremely well. As such, brading a surface significantly not only increases surface area, but also the potential for hooking.

Cyano bonds well to rubbers, metal, leather, balsa, hardwood, and some plastics. Trace amounts of water present at the surface of the material to be bonded trigger the catalytic setting process. Materials that have an acidic surface (e.g. certain hardwoods and low surface energy plastics) are more difficult to bond and require special grades of cyano; surface primers aid adhesion here by increasing the cyano's surface energy to improve wetting.

Cyano's unique chemical structure allows it to bond in seconds and makes it an excellent adhesive for most applications.

thin penetrating 'white' glue that's ideal for strengthening and toughening the joint.

**Best joints and fillets** – For maximum bond strength don't leave glued joints open for too long and avoid repositioning as this may weaken the joint. When using thick grade cyano, apply it to one surface, mate with the other, then squash the glue into a thin layer. You can also add a fillet of thick grade and cure it with a quick spray of accelerator.

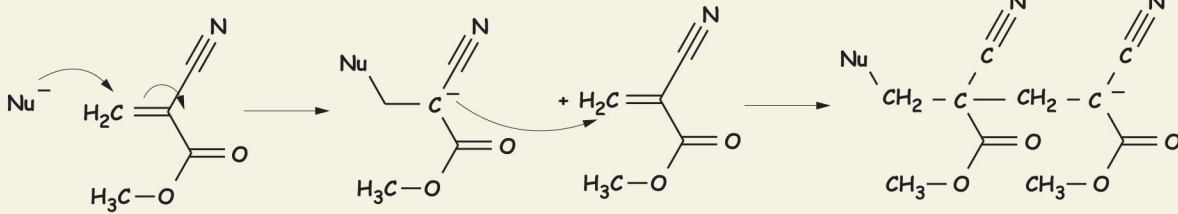
**Opening the bottle for the first time** – For the sake of safety – in case there's excess pressure inside – be sure to hold the bottle away from

your face. Also, rest the tip against a solid surface when you cut it.

**Bonding foam** – There are many types of aeromodelling-suitable foam on the market and they're not always easy to identify. To be sure that foam won't melt on contact with cyano, use an odourless grade on one surface, particularly with EPS, EPO or Depron. Bring dry surfaces, previously treated with kicker, together for a fast bond. Normal cyano may successfully bond other types of foam (e.g. EPP and EPO), but check on a piece of scrap beforehand.

**Removing surface marks** – Cyano de-bonders are available that will

**Fig.1**



quickly dissolve cured superglue marks. Blooming marks, incidentally, can be polished away with fine plastic polish.

**Filling gaps of over 0.5mm and creating strong fillets** – Use thick cyano, then apply kicker to cure the glue. For larger gaps, use a special filler powder and add thin cyano. Cavities or lost material are easily replaced using this method.

**Bonding smooth plastics, e.g. polycarbonate acrylic** – Abrade the surfaces and use kicker or primer to assist the process.

**Bonding shiny, 'oily' plastics and other tricky materials, e.g. EPP foam, polythene, silicone rubber, polypropylene and Nylon** – Use surface primer to coat the surfaces, allow to dry, then apply cyano. Press together and hold. Note that before applying any primer you may need to clean the surfaces with cigarette lighter fluid or paraffin to ensure that any mould release agent (used during the manufacture of the plastic) is removed.

**Reinforcing joints** – Try using a small piece of photographic film behind.

**ACCIDENT CARE**

Accidents can occur, no matter how vigilant you are. Hopefully the following advice will help you out of one or two inevitable sticky(!) situations. If something does go wrong and you have any concerns or doubts, always seek medical advice.

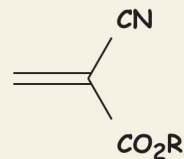
**Stuck fingers.** If you glue your fingers together, immerse the bonded area in warm water and then – perhaps with the aid of a teaspoon – roll or peel the surfaces apart. If necessary, try a specialist cyano de-bonder, working it into the skin, or try nail varnish remover. Wash the skin thoroughly afterwards.

**Ingested glue.** It's almost impossible to swallow cyano as it solidifies instantly in the mouth whereupon saliva will dissolve it in 24 hours. Although cyano is non-toxic, don't swallow it.

**Eyelids.** Consult your doctor. Cyano will dissolve in 1 – 4 days.

**Burns.** A large amount of cyano spilled onto skin can cause burns. Wait for it to solidify, remove it, and treat the affected area of skin as if it were a regular burn.

**Fig.2**

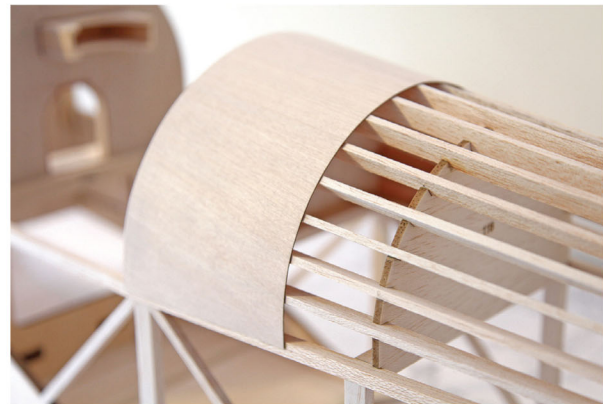


WHERE R =  
METHYL, ETHYL, BUTYL,  
METHOXY ETHYL, 2-OCTYL

**STUCK FAST**

Hopefully the above will help you get more from cyano in future; it really is a wonderful adhesive that has a multitude of uses, within aeromodelling, and beyond.

*Many traditional builders augment their white glues with cyano simply to speed assembly times and reduce weight.*



Fast, accurate and simple fabrication of your parts.  
1 machine - 1000 possibilities!

**STEPCRAFT.**  
BECOME AN EXPERT



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