

## **1. What is Cyanoacrylate (CA) and how does it work?**

**Cyanoacrylate** (C<sub>5</sub>H<sub>5</sub>NO<sub>2</sub>) is an acrylic resin that cures almost instantly. The only trigger, or catalyst, it requires are the **hydroxyl ions** in water. Since virtually any substrate you may want to glue will at least have trace amounts of water on its surface CA will adhere to most anything.

When CA comes into contact with water it undergoes a process called **anionic polymerization**. In short this simply means the CA molecules start linking up into chains and these chains start whipping around to form a durable plastic mesh. The glue thickens and hardens until the thrashing molecule strands can no longer move.

## **2. What is the shelf life of CA?**

If properly made and packaged CA can last 1 – 2+ years. The bottle that the CA is packaged in is a vital link to the shelf life of CA. Mercury Chemist have tested over 4500 different HDPE resins and there are only a handful that can properly store CA and isolate the liquid inside from the moisture in the air. The cap or closure is also very important to sealing out the water vapors that exist in the air we breathe. The Mercury bottle uses proprietary resins in the molding of the bottle and has a highly engineered triple seal closure to keep moisture out and the product fresh. This is another reason why Mercury is the only company that offers a 2-year unconditional warranty on their products.

## **3. What is the best way to keep CA fresh?**

The handling of the product, once opened, is very important to the life span of the product. Always keep the cap on when not in use, keep the nozzle clean from excess glue and contaminants, keep the CA bottle away from accelerators, and store the sealed bottle in a cool dry place.

Storing CA in the refrigerator, in an un-opened container, will keep the product fresh for a long time. Do not freeze the CA; 40degrees F is an ideal temperature. Once you open the bottle do not put the bottle in and out of the refrigerator as this will introduce condensation to the inside of the bottle which will react with the CA and it will start to set up.

## **4. Why do CA fumes burn my nose / eyes and make my eyes water?**

The fumes that you see coming from a glue joint is from the heat that is generated during the anionic polymerization process, the fumes do carry the cyanoacrylate within them, therefore when they come into contact with mucus membranes (such as the nose, throat or eyes) the cyanoacrylate reacts with the moisture contained within these areas and cause a burning sensation. This process is not harmful to the body but can be irritating; in some people it can be extremely irritating. This is not an allergic reaction although some people are sensitized to this.

To prevent problems all you need to do is make sure you move air across the work surface with a small fan. The CA vapors will dissipate very quickly into the air and become saturated within the surrounding air. If you are one of the few people that are very sensitive to the fumes you can use the low odor M100F or M1000F CA, which will not fume and cause problems.

## **5. Why are there different viscosities of CA?**

CA comes in different viscosities so it can be used for a variety of applications. All Mercury products have the scientific viscosities rating right in the name. The thin (M5T)

CA is 5 cps (cps stands for centipoises which is a scientific measurement for viscosity. 1 cps would be equivalent to water, which is a very fast wicking grade CA. To use this product you would hold the 2 pieces together and apply a small amount of adhesive at the joint, it will wick or suck into the joint and set within a couple of seconds.

The medium (M300M) is 300 cps, which is great for porous materials or anywhere you may need minor gap filling qualities. To use this product you apply it to one of the surfaces you want to glue and put the 2 pieces together and hold for about 15 seconds. This product takes 15 to 30 seconds to bond so you do have a little time for positioning.

The thick (M1100G) is 1100 cps, which is used for maximum gap filling or anytime you need working time for re-positioning or to assure a good alignment between your parts. The working time of this product is 45 to 60 seconds.

## **6. What is flexible CA?**

CA by its very nature is extremely brittle and cures very hard. While this can be a very good attribute there are circumstances where this can be a negative attribute. Take for example high vibration or high stress areas, the CA can be fractured which would compromise the joint in these areas. Several years ago the Mercury lab formulated a process where we can add a very specialized rubber to the formula giving the product the ability to resist vibration and movement. Mercury M3500FX was born and gives this product the ability to be used in areas where CA has never been used before, such as speaker construction or motor mounts.

If you attempted to shave a bead of regular CA it would just powder up as you cut it. If you did this with Flexible CA you would actually be able to shave pieces off of the bead without it turning to powder.

## **7. What is the M100XF High Performance all about?**

M100XF is the result of nearly 2 years of lab work by Mercury Chemist. This work has resulted in a formulation that is among the fastest, strongest and highest quality ever available.

This product is from the Ethyl family of CA with a few proprietary additives included to increase speed and strength. M100XF is 100cps in viscosity but yet still has very good wetting out qualities when applied to a joint, it will not wick into the joint but will soak into the joint and surrounding wood to make a very strong bond. M100XF can be used by either applying to one surface before positioning or it can be applied to the joint after the parts are positioned. With these properties M100XF is a great adhesive for using over the existing joints in ARF aircraft where a good once over is needed before the first flight.

Another strong attribute is it's low vapor properties, while it is not a low odor product like M100F or M1000F we have noticed, during the many hours of testing, that M100XF does not produce the same amount of vapors as the standard Ethyl grade CA.

One of the best uses for this product is on poplar plywood, or as we know it Lite-ply. We have also found it to work great when sheeting with balsa or working with any tough to bond surfaces.

The reason this product works so good on the poplar plywood is due to the high alkaline content of poplar. Alkaline is a neutralizer to cyanoacrylate, which will prevent the product from reacting with the moisture in the wood; in this case an accelerator would be used to promote the curing process. The accelerator will cure the CA but with a more brittle joint, the vary thing we want to avoid when gluing plywood.

Based on extensive testing this product is a great choice for assembling the ARF type models. Because of the extensive use of poplar plywood in these models most manufacturers use a PVA (polyvinylacetate) type of glue. This glue is an air-drying adhesive that cures by solvent evaporation. Simply put, when the water, that carries the adhesive to the joint, evaporates the adhesive that has spread into the joints grain and crevices dries and forms a flexible, mechanical bond. These types of products are heavy, slow and do not possess the strength of CA.

With the excellent wet-out capabilities of M100XF you can go over the joints on your new ARF and be assured the glue joints are solid. Also you can use this product during the many assembly and gluing steps required to complete the model.

### **8. What is Low Odor or Foam Safe CA?**

Low Odor CA is a modified CA that produces very low odor and blooming. This product works great if you are sensitive to the CA fumes or are working with foam. Standard CA will attack most foam while the modified low odor M100F and M1000F CA is very foam compatible. Of course it is always a good idea to test the product on a small non-visible area of your project before using any products on foam. This product, by its chemistry, is not as surface insensitive as regular Mercury CA so an accelerator like the popular Mercury MH16 may be needed. Surface insensitive simply means it will require more hydroxy ions, or water than other products. Some substrates, such as foam, have very low water content so an accelerator like Mercury MH16 is recommended.

### **9. How strong is CA?**

CA is extremely strong, it is not unusual to see tensile strengths upwards to 2 tons per square inch! If your old enough you may remember a television commercial where a person is hung by his hard hat, which has been glued to the crane with CA (Super Glue).

As strong as CA is in tensile it is considerably weaker in shear or peel forces (These are forces applied perpendicular to the bond line). This is why it is important to understand what forces will be applied to the joint and what the products being bonded can withstand. While CA is not near as strong in shear as it is in tensile a glue joint is only as strong as the substrates being bonded, for example, if you were to bond balsa wood the balsa wood will always break long before the glue joint would fail, no matter what the forces are.

Given all the products we presently use in the modeling industry today it is safe to say that a high quality CA like mercury products will withstand any forces the substrates can withstand. This is why Mercury products are so widely used today, they are very fast, very strong and since it only takes small amounts to do any job it is the lightest adhesive available.

### **10. What does triple distilled mean? Is my CA pure?**

You may see advertisements stating, "Our CA is Triple Distilled" To a scientist this simple means it is not pure and needs work. To distill something is to use temperature to remove impurities. The product being distilled is first heated to a temperature that converts it into a gas and then it is passed through a condenser where it is quickly cooled to condense it or bring it back to a liquid state. During the heating process, while it is converting to a gas the impurities fall to the bottom of the reactor and are left behind. The condensed liquid is now a purified version of what it started out as.

Triple distilling is a bit of a misnomer, in the past it has been explained that triple distilling means it is a better product, while technically this is correct because it is

considerably better than it was when it started, why did it take 3 distillation processes to get it purified? The answer would be because it wasn't very pure after the initial processing. Just because you triple distill the CA doesn't mean it will be 3 times as pure, the first distillation will remove the largest amount of impurities with it falling exponentially after each distillation. If you start out with a product that is 95% pure, after the third distillation you will only be able to obtain about 97.5% to 98% purity.

Mercury Adhesive products are not industrial remnants or leftovers (as are most current CA products) and actually come out of the in house reactor at 98% to 98.4% purity, before distilling. Then they go through a single distillation which brings them into the mid to high 99% purity level. This high purity level is another reason that Mercury can offer an unconditional 2-year warranty.

### **11. Where are cyanoacrylates made?**

There are only a handful of actual manufacturers of Cyanoacrylate in the world. Manufacturing CA is a very involved, complicated and expensive process. While it is true that there are "re-packagers" of CA in the USA there is only one true manufacturer. Mercury Adhesives products are specially formulated and manufactured in Alpharetta, Georgia where over 2 tons per month are produced with in-house reactors. All the other products sold in the hobby market are made overseas and are some times industrial remnants sold to the highest bidder and then shipped into the US in bulk for re-packaging.

The problem associated with shipping CA from overseas is simply the time lines it takes to produce the products, package the products, and ship them to their final destination. Once the products are made they typically sit in totes in a warehouse waiting to be sold, this could be several months in un-controlled environments. Once product is sold it is scheduled to be filled into bottles, typically taking another 30 days, then they are shipped to the US, which takes a minimum of 8 weeks on the water (which by the way is the worst environment for CA). Once they make port they can sit anywhere from 2 to 4 more weeks clearing customs before being shipped to the customer, again all in un-controlled environments. At this point the products are put into another warehouse where they could sit for several more months waiting to be shipped to the retailer who sells to the end user. By the time the products reach the retail shelf they can be as much as 12 months old or older. The only way to assure an acceptable shelf life to the consumer, who purchases this product from the retailer is to over stabilize the product with added chemicals which greatly reduces speed, strength and consistency of the CA.

Since Mercury Adhesives are made in Georgia these time lines are reduced dramatically. Being one of the largest producers in the world fresh batches are being produced every day which means that product never sits in totes for more than a few weeks and in most cases product is made to order. By the time Mercury products reach the retailer it is never more than 60 days old, this means Mercury can make a much higher quality more aggressive product since we do not have to over stabilize our products to deal with the long time lines getting product to the retail shelf. This is also another reason why Mercury Adhesives is the only company to offer a 2-year guarantee.

### **12. Why does the nozzle on CA bottles always clog and how can I keep them from clogging?**

The CA in the tip of the nozzle is reacting with moisture in the small orifice and hardening. Typically once the CA hardens the user will take a pin and stick it down into the nozzle to open it up only to find it clogs up even quicker the next time. What happens is the pin scratches the inside of the nozzle, which allows even more CA to stay in the nozzle causing it to clog up quicker. This process will be repeated several

times until the nozzle is no longer able to be used and gets thrown away.

Some companies have claimed to have a clog free nozzle, which in reality is only a very long nozzle that you keep snipping the clogged end off until there is no nozzle left and still end up throwing it away. Other companies simply sell you extra caps and nozzles so you can replace them after they clog.

Mercury Adhesives has actually engineered a nozzle that not only will not clog but has 3 different points of seal to assure the product inside is kept fresh and away from moisture. This cap has a blunt nose, stainless steel pin molded into the cap, which engages into the orifice of the nozzle (not scratching the insides of the bottle) to keep the orifice clean. Inside the tip is a calculated venturie shape, which pulls the CA out of the tip and back into the bottle once the bottle is stood upright. On the very tip of the nozzle is a tapered seat which engages with a tapered boss in the cap creating compression on the tip of the nozzle keeping the nozzle clean and the product inside fresh.

If the cap is replaced each time the user is finished with the product the nozzle will never clog.

### **13. What is blooming (or all this white stuff)?**

The phenomenon known as blooming is when the CA vapors leave a white haze behind after curing. This is typically caused by a couple of things. Too much adhesive is used, too much accelerator is used, high humidity environment, and improper ventilation around the part while the CA cures.

If an excessive amount of CA is used you will get excessive gassing during the cure process which will cause blooming. If accelerator is used in excessive amounts it speeds the curing process up so dramatically that you will get a large amount of gassing during the curing process causing blooming. The excessive moisture associated with high humidity acts just like using too much accelerator. Improper ventilation during curing will allow the vapors to build up on the surface and cause blooming.

Blooming is strictly a cosmetic issue and has nothing to do with the quality of the bond, if blooming cannot be tolerated at all than it is good to use a low odor product that will not gas or bloom.

### **14. What is Accelerator?**

The Mercury MH16 Accelerator is a solvent that is used to speed up the cure of CA. It typically is one of three base ingredients, Alcohol, Heptane, or Acetone. Alcohol is the least aggressive and most substrate friendly product. Heptane is a very good all purpose accelerator as far as speed and substrate compatibility goes. Acetone is the most aggressive and least substrate compatible product. Most available accelerators are either Acetone or Heptane.

Mercury uses a Heptane base with proprietary additives to give us a nice blend between speed and aggressiveness. Our accelerators are foam compatible as well.

### **15. Does the use of Accelerator compromise the bond of CA?**

Depending on the type of accelerator and the amount of accelerator used yes accelerator can compromise the bond. Typically accelerator shocks the CA into curing causing a more brittle joint. In some case the CA can be shocked so violently that it will actually foam up introducing air into the joint. Accelerator should never be used with thin CA and there are times, if used properly (like making fillets or filling gaps) it is

perfectly acceptable to use accelerator. If accelerator is used always use it sparingly.

Mercury Adhesives accelerator has been formulated to be a bit less aggressive so as to not shock the CA but simply speed up the set time needed. The most common use for accelerators is to help with hard to bond substrates.

#### **16. Why are some substrates more difficult to bond than others?**

Not all substrates are created equally, some substrates, like foam have very low moisture content. Some substrates like light-ply have high alkaline content.

Foam, with its low moisture content can be very difficult to bond, often requiring the use of accelerator.

Light-ply, with its high alkaline content, can be very difficult to bond because alkaline is a neutralizer to CA which makes it very non-reactive. In the case of light-ply the use of an accelerator or our M100XF High Performance CA can be used.

M100XF has been specifically formulated to handle the high alkaline levels in some woods giving the same speeds and strength without the use of accelerator.

Some plastics like polyolefin's can be very difficult to bond and may require a primer be used before applying the CA.

#### **17. What is Debonder?**

Mercury M68DB Debonder is a solvent, typically acetone based that dissolves dried up CA. It can also be used carefully to separate 2 parts glued together with CA.

#### **18. What are threadlocks and how do they work?**

Threadlocks are anaerobic adhesives, this means that they cure in the presence of metals and the absence of oxygen. To use threadlocks you simply apply them to the threads of a bolt and tighten the bolt. Once the threadlock comes into contact with the metal bolt and the oxygen is removed during the tightening process it will cure on the threads and prevent the bolt from loosening.

#### **19. What is retaining compound?**

Retaining compound is also an anaerobic adhesive that is used to retain bearings in seats and gears on shafts. Retaining compound is typically more aggressive than threadlocks and usually sets up faster and requires heat to get the parts separated.

#### **20. Why are there different color threadlocks?**

The different color threadlocks are for different applications.

The MTL222 purple is repositionable and is used for small, fine threaded fasteners.

The MTL242 blue is a medium strength, repositionable and is used for larger fasteners.

The MTL271 red is a strong, permanent product, which is used wherever extra strength is needed. This product does require heat to separate the parts.

The MRT09 green is retaining compound.