Just a note of interest regarding the Jeffco/Car Gas subject.

John Slade (CanardAviation.com forum) tried to use a non-EZ-Poxy solution and had his strakes fail as a result.

When he went in and repaired them this is what he used for the final coating:

    "I just had a long talk with Steve at [http://www.fibreglast.com](http://www.fibreglast.com/). They're 1110/69-A Vinyl Ester Resin system is used for underground fuel pipes and in aerospace fuel applications. They claim that it's highly resistant to ethanol and other gas additives."

That was in late 2009 and he has had no problems since. You can read the entire thread here.

    <http://forum.canardaviation.com/showthread.php?t=4594>

Also of note, Perry Mick has been running a Rotary burning Mo-Gas since 1998. He used the recommended EZ-poxy with E87 hardener  and post cure as recommended by Gary Hunter and burns ethanol on many occasions without issue.

I'm planning on using John Slade's technique when I build me strakes for my Rotary powered Long-EZ.

Tom Mann
Long-EZ N200LZ (in construction)
Velocity N951TM
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John Dibble commented

It may be good against auto fuel as formulated.  However when vapors condense at the upper part of the tank, drops of water/alcohol will be present and the Jeffco data indicates that both water and alcohol will swell (soften) Jeffco.  Failures have occurred.

For clarity, leaching is when a liquid removes additives like plasticizers, rendering the plastic hard and brittle.  Softening is when the liquid soaks into the plastic making it softer and weaker.

John

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Which is why I decided on Vinyl Ester when constructing my new sump tank. Vinyl Ester is the same resin used to build underground tanks used to store auto fuel at the corner filling station. It is also the resin used in constructing the Lancair and Glasair aircraft and I have not heard of any fuel issues with those aircraft.

The downside of Vinyl Ester is it smells really bad/strong, it has a very short working life and shelf life. You cannot get Vinyl Ester resin to bond to epoxy (but you can get epoxy to bond to Vinyl Ester.)

The upside is it's resistance to fuel and other corrosive chemicals which negates the need for an additional coating (as is done with Jeffco over epoxy) which equates to a weight savings by skipping that step. Vinyl Ester is also cheaper.

Tom Mann
Long-EZ N200LZ (in construction)

Velocity N951TM
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Gary Hunter’s take:

No matter the resin system, the best chemical resistance performance is had when the resin system is used to form the primary structural laminate rather than just a coating over an inferior laminate.

The reason for this is  - in general the laminate is much thicker than a coating.   No laminate or coating is 100% resistant to chemical attack – like that of Teflon for instance.

When a chemical or solvent (auto gas, water / alcohol) comes in contact with a substrate(laminate or coating) – it will diffuse or migrate into the surface of the coating or laminate a few microns at a time.  The rate of diffusion into the substrate will diminish with time and eventually stops.  With a thin film coating, it may diffuse completely through the entire film thickness.   Depending on the aggressiveness of the chemical, it may only take a few weeks for that to occur – or several years.   And when that happens the physical properties of the coating, such as hardness, heat resistance, tensile strength, will become seriously compromised and the volume will increase causing the polymer matrix to swell.  In a thin film, the swelling will cause it to delaminate from the underlying substrate.    However, with a much thicker laminate, the diffusion is likely to stop well short of penetrating the entire thickness the laminate. Granted the immediate surface of the laminate may be discolored, softened and compromised somewhat – but the underlying laminate remains unaffected and retains most of its performance attributes.

So, one should not expect a simple coating to be the ultimate answer to a chemical resistance problem – unless that particular coating was specifically formulated and designed to deal with that particular chemical.    Such as Jeffco.     BUT….  there is always a “but”,  if the Jeffco was not mixed properly, or applied and cured under the proper conditions – it to can be compromised to the point of failure.  AND, if the chemical is something different than what the coating was designed to handle (water / alcohol -  for instance) the coating can become compromised to the point failure this way too.   We have seen cases of this happening with Jeffco.

These scenarios hold true for coatings made with Epoxy or Vinyl Ester too.   This is one reason I advocate that one uses a thin layer of fiberglass when lining fuel strakes with EZ-Poxy.  The fiberglass helps to build the coating thickness.  In addition, an elevated temperature post cure of some sort will enhance the crosslink network of the coating and maximize chemical resistance.

Inherently, vinyl esters do not cure well in thin film applications when exposed to open air.   The cross linking mechanism (free radical) is inhibited by the presence of oxygen.   As a result, the surface usually remains a bit soft and sticky.   The underground fuel tanks manufactured for auto gas are manufacture from the inside out.  In other words, the surface that will come in contact with the auto gas is molded up against a mold surface, precluding oxygen exposure during the cure.  Thus the inside surface cures properly and obtains maximum chemical resistance.  Furthermore, the laminates are so thick, that there is a fair amount of exotherm that will “insitu” post cure the resin matrix.   This is not possible when using Vinyl Ester to coat or line the inside of the fuel strake.

Epoxies do not have near as much trouble curing in thin films as does vinyl esters.   Especially the faster curing systems.   Thus, Burt recommended the RAEF (fast) curing agent for fabricating the fuel strakes in the early days of the Vari-Eze plans.

EZ-Poxy is unique in this way.  It has practically no problems with curing in thin films in open air.   Thus, I recommend EZ-Poxy to build your fuel strakes.   Unlike vinyl esters,  it will bond to any underlying substrate that is properly prepared.

**Regards,**

**Gary Hunter**
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