

G.R.P.

Glass Reinforced Polyester is otherwise known as fibre-glass work. There are numerous brands of Polyester Resin and suppliers which makes it important to ask for information from the company that supplies the material.

Polyester is actually a form of plastic which in turn is a by product of the Oil industry (see separate sheet on plastics).

Polyester Resin is a Thermosetting plastic which means that its molecular structure is irreversibly changed during its curing process.

As a plastic, polyester is very brittle which is where the glass reinforcing comes into play. The materials that can be used to reinforce the resin vary in types, strengths and cost. These will be covered later.

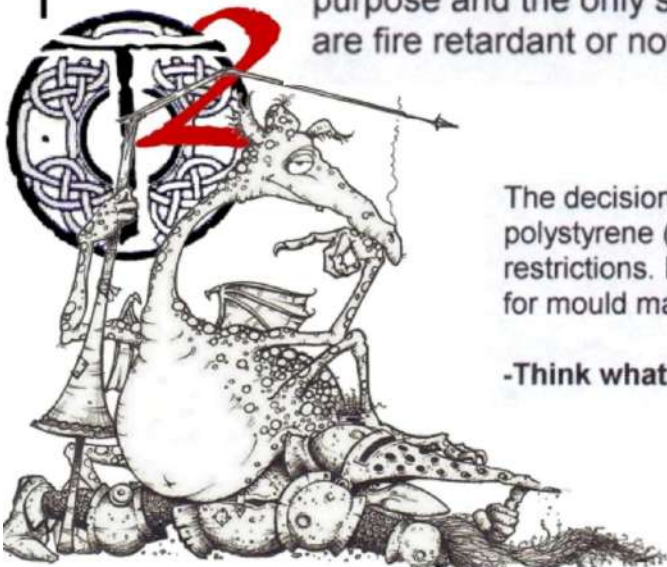
In its liquid state polyester is suspended in what is known as a monomer which in this case is Styrene. The smell often associated with fibre-glass work is caused by Styrene fumes. In order to change from liquid to solid state a catalyst is added and this begins the change in the molecular structure of the polyester resin.

All Resins must also have an activator added to them in order for this process to happen, most Resins will already have been activated before they are bought - but not all of them - so it is important to ask when ordering.

There are specialist resins that have been developed for specific jobs but the ones used in Prop making are usually general purpose and the only special aspect about them is whether they are fire retardant or not.

The decision about when to use FRA is very similar to those for polystyrene (see sheet) - does the final product need to pass fire restrictions. If it is for performance the answer is yes but if it is for mould making this isn't always the case.

-Think what the application is to be.-



When being used as a mould making material the first layer of resin is a specially thickened version called Gelcoat. Being thick this layer tends to stay on awkward surfaces better than the liquid resin which will pool. In a sense you are giving a neater surface finish to the model being cast. Gelcoat uses the same percentage of catalyst as normal resin so it isn't necessary to remember a whole series of different figures. Gelcoat has been specially adapted to always remain slightly tacky on the surface open to the air to allow better adhesion when the second layer of normal resin and fibre-glass mat is added.

It is also often used as the first layer of a cast taken from a mould because the gelcoat reproduces very good detail.

Catalyst is required to start the resin molecular change and in Polyester resins case this is Methyl Ethyl Ketone Peroxide.

MEKP as it is more commonly referred to is a dangerous product and gloves must be worn when being worked with. As a catalyst there are set amounts by percentage that are required to work with the resin, being negligent with these can cause problems.

This breaks down to 2% and although it is possible to reduce this it should be no less than 1% or the reaction will not work efficiently. However never use more than 3% as this is where problems occur. Some people will work with 3%+ on a regular basis - known as a **Hot mix** - but this is a bad habit to get into as a great deal of resin can be wasted.

Polyester resin cures as a result of heat created by the chemical reaction - exothermic - but this greatly increases with more catalyst and the resin mix will literally become hot and will cure very quickly as well as giving off very obnoxious fumes and possibly burst into flames. If you get into this habit you will not be popular with your neighbours.

**MEKP MIX FOR RESIN -
10cc / 1/2 ltr of resin .**



It is possible to pigment both Gelcoat and Resin and there are numerous colours available.

There are a number of factors that can effect fibre-glass resin work and it is useful to know something about these.

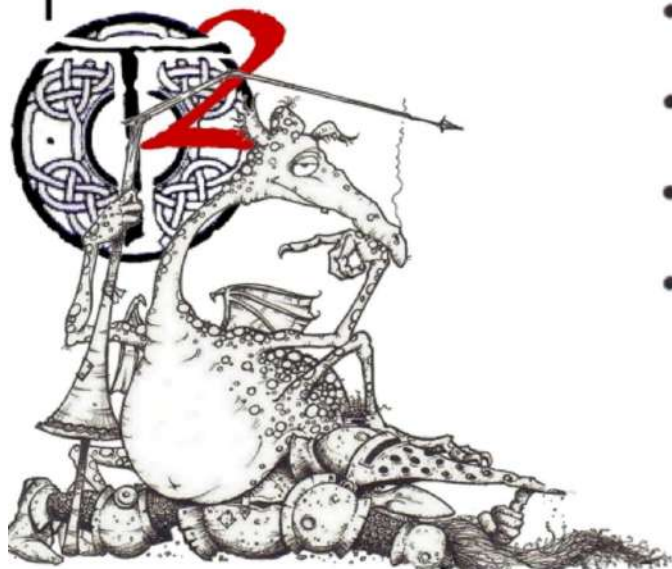
- **Surrounding temperatures - hot and cold -.**
- **Not enough catalyst added.**
- **If too much pigment is added to the resin.**
- **Gel coat not fully curing because the catalyst has not be thoroughly mixed.**
- **The moulds are damp.**

This last point is a major problem because resin will not fully cure if it touches moisture, any plaster mould must be properly sealed to prevent this. The choice of plaster used for moulds for fibre-glassing can help this. (see Plaster sheet).

The others can usually be sorted when you prepare the work.

Once a layer of Gelcoat has been allowed to cure - around 30 minutes - the laminating process or reinforcing can begin. There are a variety of materials that can be used for this laminating;

- **Chopped strand mat.**
- **Woven roving.**
- **Kevlar.**
- **Fibre Tissue.**
- **Carbon fibre.**



The most frequent material used in Props is chopped strand mat, a multi-filament glass fibre sheet. These filaments are held together in sheet form by a resin soluble binder. These sheets come in different thickness' but are bought according to weight.

- 300 gsm.
- 450 gsm.
- 600 gsm.

Of these 450 gsm is normally used.

300 gsm is excellent because it is quite thin and takes to difficult shapes very easily and is often called gelcoat mat, unfortunately this reflects in its price and is at least twice the cost of 450 gsm.

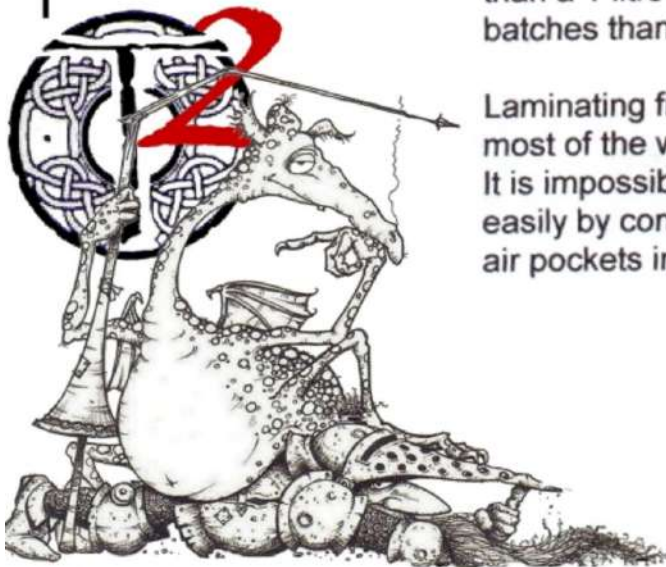
The other useful point about **450 gsm** is the resin to mat ratio which happens to conveniently be;

- A Litre per metre. -

Remember that the working life of a mix of resin will vary dependant on the surrounding temperature so in cold weather you are likely to need the higher amount of catalyst.

Do not be tempted to mix up huge quantities of resin in one go as the exothermic reaction will start to effect a 4 litre mix quicker than a 1 litre mix so as a rule it is wiser to mix four smaller batches than one large.

Laminating fibre-glass mat is a relatively simple process and most of the work is taken up by preparation. It is impossible to work in a messy environment as the mat can easily be contaminated with bits of debris and this may lead to air pockets in your finished work.



The mat or other chosen backing material needs to be cut into manageable pieces so that lamination can begin. If these are placed on a scrap board, stippled by brush with the resin and then placed in a neat pile the bonder in the mat dissolves and the mat becomes flexible and the fibres malleable.

An advantage of making these small bundles is that the mat also soaks resin from the piece it is laid on top of and this actually reduces the amount of resin needed. Normally two or three layers should be ample for most Prop work.

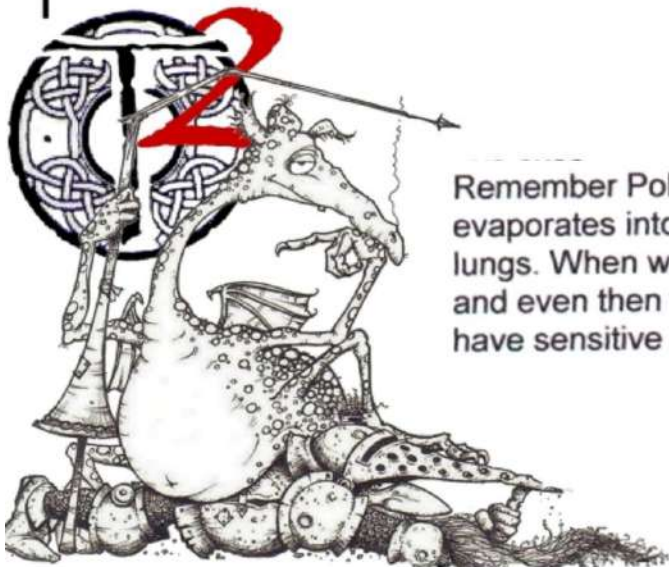
Some of the other materials are occasionally used Kevlar is extremely strong and brilliant for any work that needs ultimate strength but it costs at least 14 times as much as normal mat per metre and is very hard to work with. Carbon fibre tape (black) actually looks like woven roving but again is exceptionally strong and is often used to super reinforce fibre-glass weapons

As it will not break, recently this has become available in tissue form which is a major development.

When work has been laminated it is possible to trim off edges an unwanted excess with a Stanley knife once the resin has turned - **'Green'** - this is a term used when the polyester is beginning harden into a plastic but it is still soft enough to easily cut - it also does look slightly green in colour.

To do this successfully needs attention and after a while experience will tell you when it is ready otherwise it is like waiting for a kettle to boil. Having said this, it will save a great deal of cleaning up time that will be necessary otherwise once the resin has gone hard.

Fibre-glass is a great asset to Prop making - it cannot be said to be pleasant, it smells, it itches, it's messy but it's of great use.

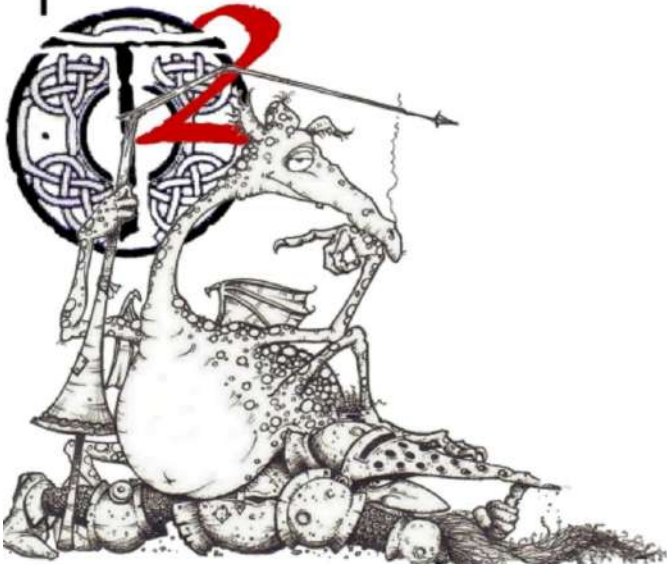


Remember Polyester is held in a suspension of Styrene which evaporates into the air - the smell - and will lay nicely on your lungs. When working with fibre-glass there must be ventilation and even then the fumes can sting the eyes so be careful if you have sensitive eyes.

Codes of practice.

- Always clean up after you.
- Clean all brushes in Acetone.
- Wear a mask with a dust/gas filter attached.
- Wear gloves.
- If catalyst lands on skin - wash with soap and water - immediately, it will burn.
- Never deliberately add too much catalyst.
- Always wear protective clothing when using fibre-glass mat.
- Do not work with fibre-glass in a T-shirt.

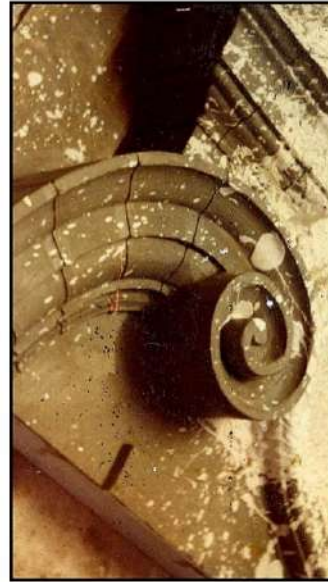
Do not spend great deal of time fibre-glassing if a job is likely to be a long one rotate with others and allow time for breaks, do not be stupid. Another useful tip if you know you are going to be doing fibre-glass work is to drink a pint of milk beforehand as this forms a protective barrier in your stomach.



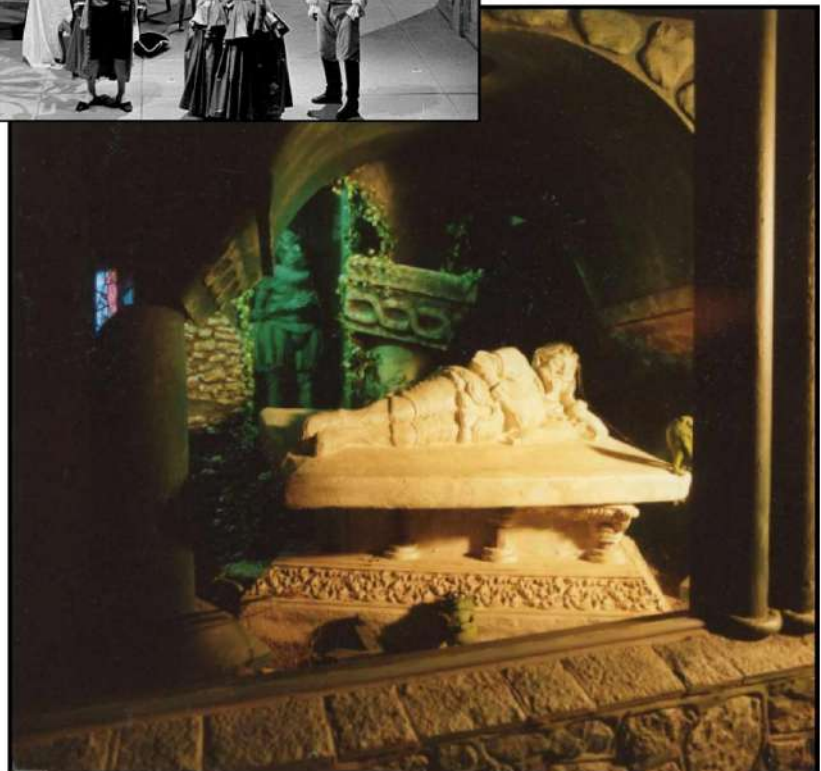


Both of these are made by turning
plaster on a EPS former
Then making a Jesmonite mould

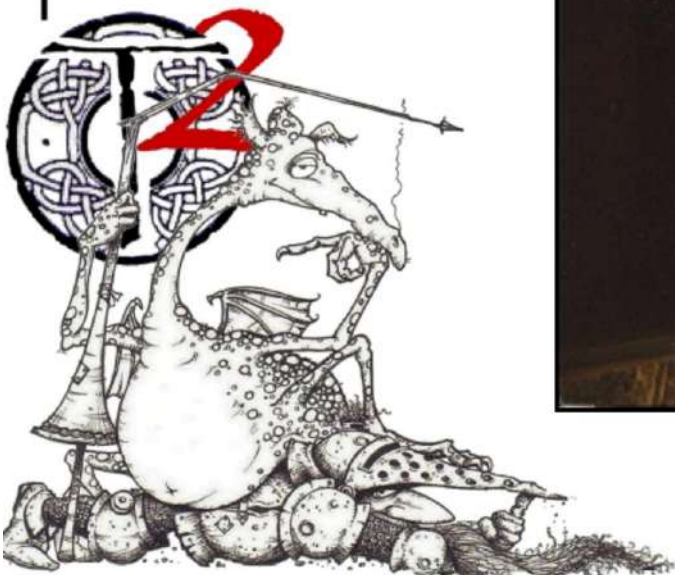
Sculpted in clay
mould taken



Fibre-glassed
Mould smashed



lost mould process





all pieces made
as seperate components
then fixed to steel
inner frame

Made to withstand
all weather conditons
including Gales





GRP sections
built on heavy
duty steel frame
due to weight of
water in
fountain

