

IMPROVING YOUR BOAT



NEW SERIES

Working with glassfibre



If you want to make a new hatch or a battery box for your boat – or even repair a gaping hole in the hull – polyester resin is the answer. Jake Kavanagh goes back to basics and enrolls in a GRP course

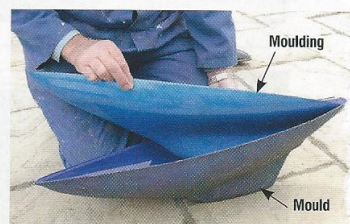
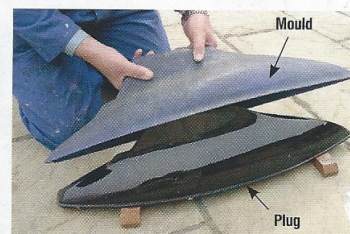
Learning to laminate

We joined an entry-level hand-laminating course, which included a City and Guilds skills test at the Southampton City College Maritime Technology Centre. The course is designed for everyone, even those with no previous experience. The cost for the five-day course is £500 including all materials. For more details, tel: 02380 434005. Alternatively, visit: www.southampton-city.ac.uk, click on 'Adult Learners', then click on 'Vocational and Part Time Course Guide'.

What exactly is glassfibre?

Polyester resin is a man-made plastic which ranks alongside natural resins such as amber, pitch and wax. Plastics have been around since the 1800s, but it was the Second World War that created the demand for mass production, and spurred research into new formulas.

The term 'plastic' can be used to describe many non-metallic products which have similar characteristics. The process by which they are made is called polymerisation.



▲ You create a mould from a plug, and from this mould you can make as many identical mouldings you like

Many PBO readers will have used glass-reinforced plastic (GRP) at some time, but not always on a boat. It is widely used in DIY as a repair agent and can be used to fix anything from a flat roof to the wing of a car. When it comes to the marine environment, the majority of modern boats are made almost entirely from 'glassfibre'.

Compared with wood or metal, the raw materials are relatively cheap. Making a complete hull is also less labour intensive. Every steel or wooden boat has to be built from scratch, but once a mould has been created the amount of identical glassfibre hulls that can be made from it is almost limitless. It doesn't matter if you are moulding a battery box or a 9.1m (30ft) cruiser, the basic elements are the same.

As with all materials there are some tricks of the trade to get the

best results, and where better to start than with a course which takes you right back to basics? We enrolled on a hand-laminating course at the City College, Southampton, (see panel, left).

The raw material

Resin is the main ingredient of GRP and is usually supplied in a pre-accelerated form. This means that it contains chemicals which only need a small amount of catalyst to trigger the hardening process.

Polyester resin is the cheapest of all the boatbuilding resins (roughly a quarter the price of epoxy) and, apart from the pungent smell of styrene, is very easy to work with.

But first we must apply gel coat. To make glassfibre look attractive, and to hide the fibre pattern of the reinforcement, an outer gel coat layer is added first. This gel coat is also made of polyester resin, but pigment has been added to create

Plastics usually belong to one of two families: thermoplastics or thermosets. Applying heat will soften thermoplastics to the point where they can be re-moulded – useful when sealing the end strands of a nylon rope.

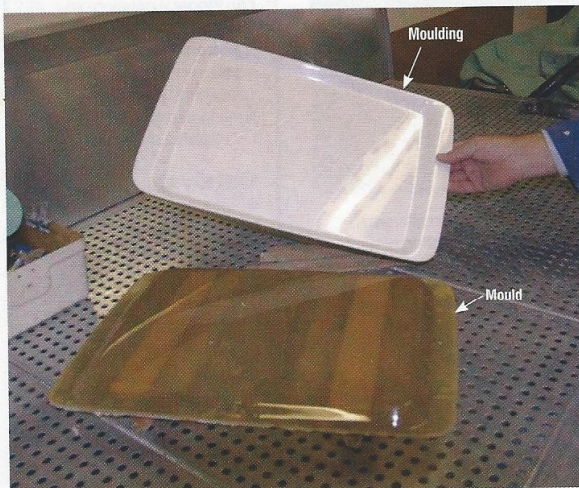
Polyester resin, however, is of the thermoset variety: once it has cured it is set forever. If a polyester resin moulding cures badly it has to be thrown away – it can't be melted down and recast.

Polyester resins are derived from coal and oil products, and once processed are made up of three basic components: acid, glycol and styrene.

Styrene is known as a monomer,

and has essential roles in resin: it acts as a cross-linking agent which enables the resin to cure from a liquid to a solid, and it's a thinner, allowing the resin to remain fluid enough to handle. Once styrene has been added to a batch of polyester resin in the manufacturing process, that batch could still gel at room temperature without the need for a catalyst, so an inhibitor such as hydroquinone is introduced to stop this happening.

The terms glassfibre and glass-reinforced plastic (GRP), come from the thin glass strands of reinforcement which are introduced when resin is 'laid-up' in a mould.



▲ A gel coat is first applied to the mould so that the finished moulding – in this case a tray – has a smooth, shiny finish when released

colour, and it's usually only about 0.5mm thick.

Polyester resin is widely available and can be bought in small quantities (up to 5kg) from your local chandlery. However, if you have a large job to do then it may be better to order your resin from a specialist supplier. A chandlery will charge you around £10 a kilogram, with the proportionate amount of catalyst being around £4. A bulk purchase could bring the cost of resin down to as little as £4 a kilo.

Once cured, the resin itself is very brittle and would be almost useless without reinforcement. In this respect it can be compared to concrete. A garden path, for example, can be cast from pure concrete, but a load bearing structure such as a bridge needs steel reinforcement, otherwise it will quickly fracture and collapse.

Once it has hardened, resin poured into a mould will exactly



▲ Chopped strand mat (CSM) comes in two forms: emulsion-bound (left), and powder-bound (right)

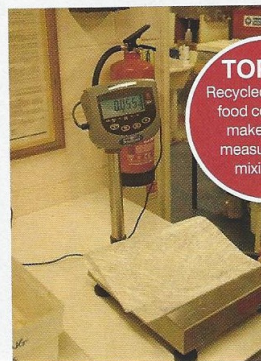
mirror whatever it has set against – but would remain brittle just on its own. So, before it hardens off in the mould, we add some flexible reinforcement, and then more resin to trap the reinforcement in place as the resin cures.

GRP reinforcement comes in the form of strands of glass, and these strands can be either randomly bunched together – as in chopped strand mat (CSM) – or machined into fabrics called 'woven rovings'.

GETTING STARTED

Basic tools you'll need to work with polyester resins and glassfibre

Using polyester resin can be a messy business, and is one that calls for some accuracy when mixing components. The catalyst, which will be mixed at a (usual) ratio of 2% is an organic peroxide which needs to be handled with extreme care. To apply gel coat or resin, invest in some cheap, disposable brushes which won't shed their bristles too easily.



TOP TIP
Recycled domestic food containers make perfect measuring and mixing jars

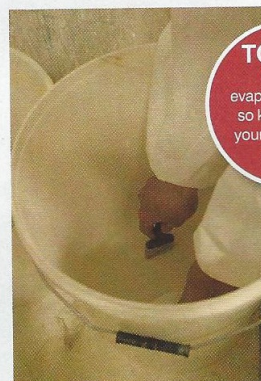


▲ We used accurate scales on our course to work out the proportion of resin to glass mat, but in the real world an educated guess will probably do

▲ Special dispensers are available for the safe decanting of catalyst, but syringes or eyedroppers are also suitable for the purpose



▲ To squeeze out any air bubbles and properly incorporate the chopped strand mat into the resin, you'll need a special consolidation roller. The most effective all-purpose types are made from detachable steel washers



TOP TIP
Acetone evaporates easily, so keep a lid on your container at all times

Before working with polyester resin prepare your hands with special barrier cream (above) or ensure you wear gloves.

Wash brushes and rollers in acetone (left). Don't wash hands in acetone: it's highly flammable and will quickly suck the natural oils from your skin

THE WORKING ENVIRONMENT



The laminating workshop needs good ventilation. Note the large extractor flues, plus the eyeglasses and protective suits being worn by the students

When working with resin, a minimum temperature of around 15°C is recommended. Below this the resin will be slow to cure – or may not cure at all. If resin has been stored in a cold area, bring it into the workshop the night before so it can get up to temperature before moulding begins.

Some glassfibre work may be done aboard the boat, in which case you must ensure it is properly vented. Remember that styrene vapour will sink and may end up in the bilge.

For laminating in a workshop, good ventilation is also essential. Our classroom was fitted with extractor fans, and there was also extraction at ground level to scoop up the heavy styrene fumes. A styrene monitor made sure we were always within the 100-parts-per-million safe working limits of our eight-hour day.

For hand protection latex gloves could be used, but polyester resins are not particularly reactive to skin (as opposed to epoxies, which can

cause dermatitis and allergies). Instead, a liberal coating of barrier cream before working with polyester may be all you are likely to need.

Always ensure that you have copious amounts of saline eyewash available. Our course tutor insisted that we always wore eye protection when working with resins – a sensible precaution. If some resin does get in your eye, keep rinsing it out with the saline solution for at least 10 minutes and then seek medical advice.



Resins are readily available from specialist suppliers – you'll often find them with a stand at boat jumbles and marine exhibitions

Looking after your resin

Polyester resin

Shelf life: 6-12 months

- Try and avoid storing resin for too long by buying it from a reputable supplier just before you need it.

- If you have to store resin, keep it below 20°C and in a cool, dark place.

- Keep the resin indoors to avoid extremes of temperature, and don't let it freeze. Tins should be kept off a cold concrete floor.

- Ultraviolet radiation (UV) can trigger a gelation, so store the resin in totally lightproof tins, avoiding translucent or clear plastic containers: even fluorescent lighting can give out enough UV to start a slow cure.

Catalyst

Shelf life: 6-9 months

- The catalyst is an organic peroxide, so also needs to be kept cool and out of direct sunlight. Only use non-pigmented plastic bottles for storage – it might react with pigmentation chemicals.

Gel coat/topcoat

Shelf life: 6-12 months

- Many of the principles listed above apply to gel coat, which is essentially still a polyester resin. Keep it in tins, away from heat and UV light. Personal experience shows that gel coat and resins will usefully keep for up to two years if stored in a cool, dark place in a full, airtight container.

Chopped strand mat (CSM)

Shelf life: Indefinite – provided it is kept away from moisture

- Chopped strand mat, both powder- and emulsion-bound, should be kept away from moisture which could inhibit the cure when laid up. Usually sold to the DIY-er in plastic bags, the bags need to be kept sealed until the material is needed. Spare CSM should then be resealed in the bag.

Next month

Basic lamination, starting with a flat GRP sheet and then progressing to an anchor locker