Instruction Guide

Carbon Fibre Laminating Starter Kit

Description

The Carbon Fibre Laminating Starter Kit contains everything you need to make basic but fully structural carbon fibre parts using a simple wet-lay process. All you will need is a mould or suitably shaped formers for your project.

Kit Contents

- 0.3sqm 2/2 twill 3k carbon fibre cloth
- 154g EL2 epoxy laminating resin
- 46g AT30 FAST epoxy hardener
- 35ml PVA mould release agent
- 0.3sqm of peel ply
- Nitrile gloves, 3 mixing pots, 3 mixing sticks
- 1 inch laminating brush
- 2 x 0.5 inch laminating brush

Uses for This Kit

- Experiment with making carbon fibre products
- Reinforce an existing product
- Repair a carbon fibre product such as a fishing rod, yacht mast/boom, vehicle bonnet etc (this will require some degree of skill and composites knowledge)
- Satisfy an urgent or small requirement for some carbon fibre and resin in a professional composites workshop

What Results Can I Expect?

The standard of the end result which can be expected will vary greatly depending upon the users level of practical skill, effort and perseverance. However, the materials contained within this kit, in combination with the practical advice detiled in this guide are quite capable of producing excellent results.

At the same time, we do not want to provide unrealistic expectations and as such, people experimenting for the first time with carbon fibre (or even composites in general) should be aware that initial attempts are unlikely to yield cosmetically perfect parts. The quality of the materials used though will ensure that structurally, the parts should still be very high performance and as familiarity of the process and dexterity when working with the fabric improves, the cosmetic finish of the parts will come through.

Principles of Wet-Lay Carbon Fibre Lamination

Using this carbon fibre laminating kit allows for the production of carbon fibre parts using a process described as 'wet-lay' lamination. This is uses a liquid epoxy resin to 'wet-out' the dry carbon fibre fabric, allowing the resin to flow in and around the carbon fibres. The carbon fibres are described as the 'reinforcement' and the resin is the 'matrix'. Once the resin cures, it is the combined properties of the carbon fibres and the epoxy matrix (together, a composite) that make the material so strong.

Laminating a product in this way requires carbon fibre to be placed down onto the inside of a mould. When the part is removed from the mould it is the material that was in contact with the mould that becomes the 'finished' side, meaning that the important part (to create the best looking product) is how the first layer of carbon fibre is laid down into the mould. Subsequent layers of carbon fibre or other reinforcement will not be visible on the surface of the part.

Choosing or Making a Suitable Mould

Before you can make your first carbon fibre part you will need to find or make a suitable mould. This could be as simple as a sheet of plastic if you were making a flat sheet, or a complex moulding made from other composite materials in the case of a more detailed part. Whatever you use as a mould for your part you will need to be sure that its surface finish is as good as you want the finish on your part to be and that you prevent the carbon fibre part from sticking to it.

Moulds for Experimentation or Simple Shapes

A good place to start for experimentation or relatively simple parts with pieces of plastic (such as polypropylene) joined together to make your basic shape. Joint lines can be improved by 'beading' filleting wax in a radius along the joint line, ensuring that when the part is removed from the mould it will have smoother, radiused corners. Alternatively, if you can find a plastic or metal part that is already the right shape (or a part of it is) then that too will make a great mould for your part. In our workshop we have used conveniently sized Tupperware containers and even curry bowls to make one-off parts like covers and even speaker-pods. 3D printers can also offer a way to easily make custom moulds.

Moulds for Production Parts or More Sophisticated Shapes

Commercial laminators generally use fibreglass moulds when producing wet-lay carbon fibre parts. Fibreglass moulds can be made into any shape and can be extensively polished inside so that the carbon fibre parts come out of the mould with a high-gloss surface finish. Information on how to make a standard fibreglass mould is readily available and you can find tutorials on the learning area of our website.

Note that epoxy will not easily release from a mould made from a polyester gelcoat/resin so you will need to make sure that the surface of the intended mould is made from either epoxy or vinylester (such as our uni mould system).

Easy Composites Epoxy Mould Making Kit

Understanding that for many people new to composites lamination altogether, the process of making a fibreglass mould from scratch is daunting and complicated to say the least, we have put together a separate kit, and guide to cover the subject.

Designed specifically for those looking for the quickest and easiest way to make high quality moulds from which to make carbon fibre parts, our Epoxy Mould Making Starter Kit makes use of a very modern approach to mould making. This method which uses an epoxy based putty-like material that can be shaped around an original part, cured, released and then used immediately as a mould. Our Mould Making Starter Kit is by no means a requirement to make carbon fibre parts. However, if you want to make a detailed mould and you aren't confident or don't have the materials to make fibreglass moulds then you may find the kit very helpful.

Step by Step Guide

Before starting to make your first part we suggest you:

1. Ensure there is enough space to work, that the work area is free from dust and protected with newspaper or similar if necessary. The recommended working temperature for this resin is 20°C.

2. Have to hand a set of scales, a set of sharp scissors and some lint-free cloth.

3. Have something suitable to use as a mould.

Step 1 – Apply release agent to the mould

The first step is to prepare the surface of the mould to prevent the carbon fibre part from sticking to it. Included in the kit is a small container of blue coloured PVA Release Agent. Alternative release agents include release wax, chemical release agent, you can also used mould surfaces that epoxy resin will not stick to (like polypropylene plastic). To make sure, we suggest using the PVA included in the kit no matter what your mould is made from.

Start by pouring about a cap full of the release agent onto a lint-free cloth. By using a lint-free cloth you will avoid any small flecks of the cloth from contaminating the coating of release agent.

Start wiping the release agent over the surface of your mould gently using the cloth. The blue colouring in the release agent is there to help you see where you've been and how thick the coat of release agent is. Ideally, you're looking to have a thin but consistent cover of the release agent all over the surface of the mould. You will need to top-up the release agent on your cloth as you go.

Do not allow any area of the mould to go uncoated which will result in the part sticking to the mould.

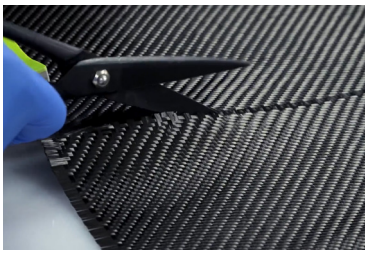
Once you have coated the part thoroughly (ensuring you have worked the agent into any awkward corners) set the mould to one side and leave it for about 20 minutes until dry to the touch.

TIP: Apply a small amount of release agent to a part of the mould that will not be used in the finished part. That way you can touch-test for dryness without risking marking the PVA on the mould's working surface.

Step 2 – Cut the carbon fibre fabric

Carefully remove the carbon fibre from the tube and lay it out on a clean flat work surface. Never lay fabric onto a work surface with any dust, uneven/rough or contaminated surface as this is the easiest way to spoil the fibre. Dust or dirt will cling to the fabric and be visible on the surface of your part and a rough surface can snag the fabric and distort it.

Work out how much fabric you will need to cover the surface of the mould. You can do this beforehand using a paper template for complicated shapes or for simpler shapes a calculated estimate can be made, always aiming to be slightly oversize as a margin for error.



Tip: *A neat trick for marking out the fabric prior to cutting with scissors is to carefully isolate a single 'tow' of carbon fibres and pull it gently out of the weave. This creates a line parallel to the rest of weave that you can cut down, helping to prevent fraying and ensuring the cut-line stays neat. If you try this technique yourself, use your other hand to gently hold the fabric flat at the other end of the piece to prevent it from being wrinkled as you remove the strand.*

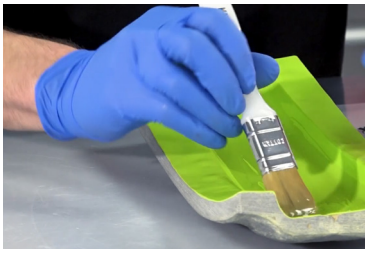
Step 3 - Mix epoxy resin and hardener

Wearing nitrile gloves, measure out the correct quantities of resin and hardener into one of the mixing cups following the mix ratio displayed on the bottles. For example the 100:30 mix ratio would result in 100g of resin mixed with 30g of hardener.

Using one of the mixing sticks stir the resin and hardener together thoroughly. Ensure you mix from the edges and bottom of the pot, unmixed resin or hardener will not cure and will ruin your finished part.

For hand laminating, the quantity of resin is equal to the weight of cloth to achieve a 1:1 ratio. A useful technique is to weigh out the cut pieces of cloth and mix up the same quantity if resin. Because it is critical to use the correct mix ratio as accurately as possible we recommend 50g of resin to be the smallest batch size to mix up, even if this means you end up with a bit left over at the end.

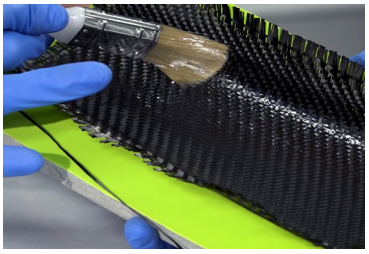
Step 4 - Lay first layer into mould and laminate



Using a brush apply a liberal layer of resin onto the surface of the mould, a good coating is required to drive the resin up through the layers of reinforcement to come.

Carefully lay the first layer of carbon fibre into the mould, taking care not to crease or distort the weave. This will be the external cosmetic face of the part and the side which is visible so it should be applied as neatly as possible. Carefully press the fabric into the layer of resin, it should begin to stay in place and take on resin as you do.

Again, use the brush to stipple the fabric so that the resin is driven up into the material, take care not to move the fabric too much. If required, add some more resin to any dry areas until the cloth is fully saturated with the resin but take care not to flood it too much. Remember the ideal part (from a performance standpoint) will use the least amount of resin whilst still fully saturating the material.



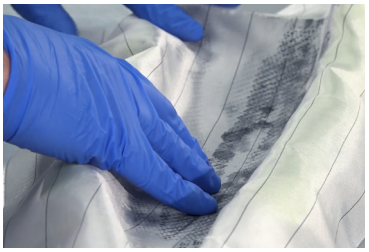
Try and avoid dragging the brush as if painting and instead use a light stippling action to work the resin into the fibres. This will help to reduce any weave distortion on the surface. Remember to pay extra attention to any corners or areas of finer detail to ensure that the fibre follows the contours of the mould and avoids 'bridging' over any gaps.

Step 5 - Laminate additional layers of reinforcement

Following the same process as above, laminate in the rest of the reinforcement by adding the resin first and driving it up thorough the cloth to ensure that it's fully wet out. This could be anywhere from 1 to 10 or more depending on the required strength of the part. It is possible to make parts with a single layer but the result would be very thin and flexible. It is less critical to be as neat with any subsequent layers as they will not be seen, however care must be taken to minimise movement in the fabric which could transfer through to the cosmetic layer.

Once all of the additional reinforcement layers have been added, use scissors to cut away any excess fabric from around the edge of the mould. Leave enough overhang to ensure that there is somewhere to grip the part when releasing, but remove any excess that could drape and cause fabric to cure held away from the surface of the mould.

Step 6 - Apply layer of peel ply and leave to cure



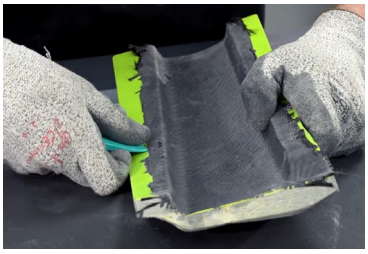
To achieve a tidy flat finish to the 'B' side of the part, a layer of peel ply can be laminated onto the last layer of fabric. This is done in the same way as with the reinforcing fibres and when torn away will produce a flat textured surface which is ideal for bonding and requires no preparation.

The part can now be left in the mould to cure. EL2 with fast hardener as included in the laminating kit can be demoulded after around 8 hours at the recommended 20°C but may need a full day in cooler conditions.

Step 7 - Release the part

Don't try and demould the part before the resin has fully cured, doing so will almost certainly damage the part. If the resin is cured but still a bit 'green' it can also be more difficult to release. If unsure it is best to place the mould somewhere warm and leave for a while longer.

Once confident that the part has fully cured the demoulding process can begin. Firstly tear away the layer of peel ply on the back of the part, this is easier done when the part is still in the mould and everything is more rigid. The process of doing so can also help to loosen the part and release it from the mould.



If the part is still in the mould then you can start by flexing the fabric overhanging the main form. Be careful to avoid splinters and the sharp edges of the part which will now have hardened with resin. If the part remains stuck then you can carefully slide plastic wedges inbetween the part and the mould face and tap them in gently with a mallet if required.

Step 8 - Trim and finish the edges

Once released, the part can now be trimmed and finished. A permagrit disk in a rotary tool is a great way to trim any excess material off the part flanges. The edges can then be sanded with a permagrit sanding block to smooth and take back to the edge of the part.

Further Finishing

Depending on how well the part was laminated there may be varying levels of surface finish with some pin holes or voiding. Larger dry areas can be filled with XCR coating resin and then sanded flat before polishing up to blend in with the rest of the moulded surface. Alternatively the surface of the part can be keyed up and coated with a clear lacquer such as Fantom Clear to achieve a high quality finish.