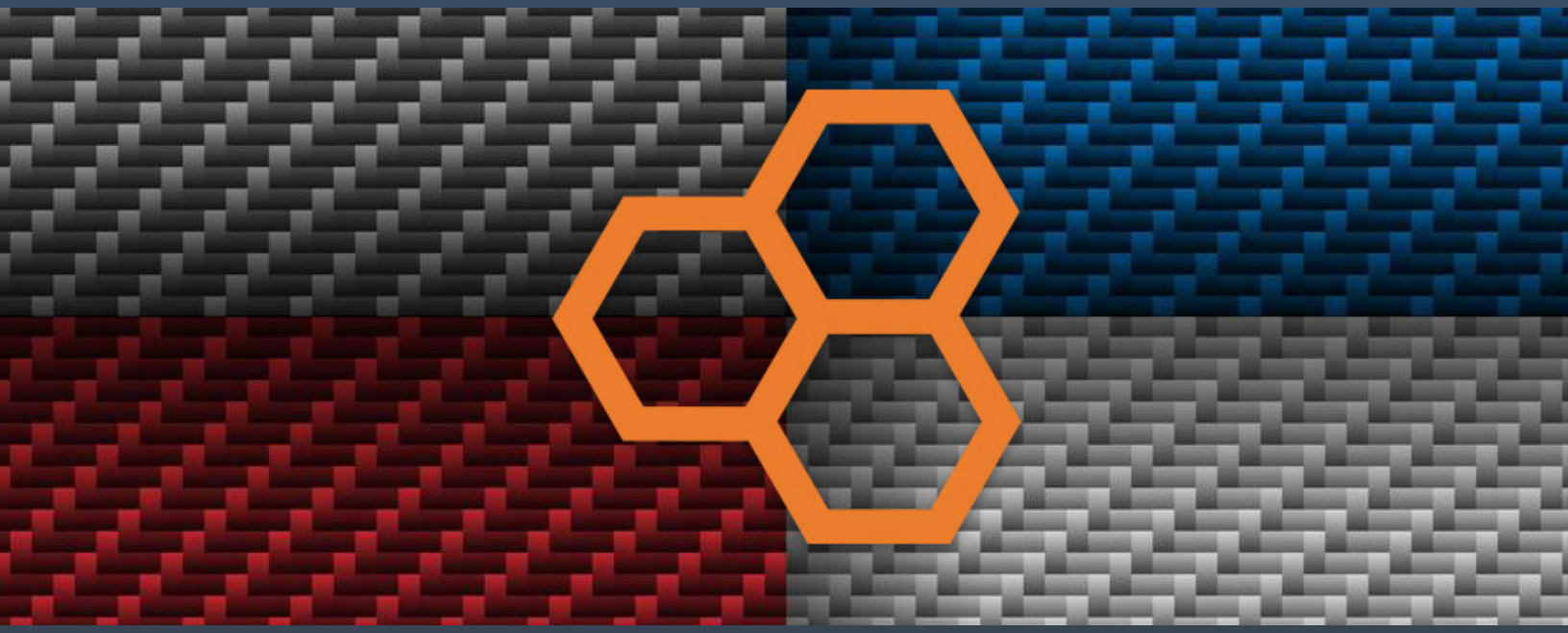
COMPOSITE ENVISIONS KNOWLEDGE HUB
PRACTICAL AND INSIGHTFUL COMPOSITES INFORMATION



RESIN TO FIBER RATIO EXPLAINED

COMPOSITE ENVISIONS

RESIN TO FIBER RATIO EXPLAINED

When it comes to figuring out how much resin is needed for a given project, planning is key. Investigating how much resin and fabric are needed, design and measurement of the pieces needed are important to gather for buying the right amount of material.

Start by writing down the estimates and measurements needed for the repair, skinning, or fabrication of the part. Figure up how much fabric will be used using the surface area of which plys will be laid. For example, having a surface area of 2 ft2 for each ply of material with a need of 3 plys.

Each fabric has a density associated with it. This is the calculation given by the fabric's weight (grams or ounces) over its surface area, usually measured in m2 (square meters) or ft2 (square ft). Using Carbon Fiber Fabric, Plain weave 6K for example, its density is 370 gsm (Grams per square meter). Through conversion to gsf (grams per square foot) it equals 34.37 grams per square foot.

CF Fabric Density: 370 gsm

(1) Gram / Square meter = (0.092903) Grams / Square foot

370 * 0.093 = 34.37 grams per square foot (Density of CF fabric)

Having known the need of 2 ft^2 per ply for 3 plys, multiply the 34.37 gsf of the fiber by 2 ft^2 for multiple of 3 plys. Giving the total fiber volume of 206.22 grams of total fiber weight.

3 Plys * 2ft^2 = 6ft^2 (Total material area for fabrication)

6ft^2 * 34.37 (Density of CF Fabric) = 206.22 grams of total estimated fiber weight

For hand Layups, the fiber / resin ratio is usually ~50% at best. For exact science, one would say 207 grams of fiber is the same as 207 grams of mixed resin. But if you are estimating, it is better to use a higher figure to ensure there is enough resin for a job. The ratio is always going to be proportional to this ratio.

Example 1: 50/50 Fiber / Resin Ratio: 207 g Fiber & 207 g of Resin

Example 2: 40/60 Fiber / Resin Ratio: (207 g Fiber * 60%) / 40% = 310.5 Grams of resin

Example 3: 60/40 Fiber / Resin Ratio: (207 g Fiber * 40%) / 60% = 138.0 Grams of resin

For estimating purposes, most heavier epoxies density is approximately 1.4 g/cm3 which converts to .04734 g/oz. Different resins come in a wide variety of densities, many manufacturer's specifications should give a good idea for calculation. Using Example 1 Figures from above, the need of 207 grams of resin, 207g multiplied by .04734 g/oz equals ~9.8 oz of mixed resin needed for a 50/50 resin to fiber ratio.

Given Epoxy Density: 1.4 g/cm^3

Conversion factor: 1 g/cm^3 = 29.5735 grams / US fluid Ounce

1.4 / 29.5735 = 0.04734 g/oz

Resin needed: 207 grams

0.04734 g/oz * 207 g = 9.8 oz of mixed resin (50/50 Fiber to Resin Ratio)

When estimating for needed resin amount, having more is better than having not enough. For all accounts of variation in composite processing, getting 30% more resin than designed is a safe bet. Still, for this job, a quart of resin once mixed would suffice.

Generalized: Most one-off jobs for a single part can be handled using a quart of resin. However, for larger hand layups a gallon would be needed. It should be noted that Chopped Fiberglass (CSM) is going to need more resin than most any other material. Woven material generally weighs less (smaller density) than CSM.

REAL WORLD EXAMPLE – SKINNING A CARBON FIBER HOOD

For a single ply of material of CF fabric: Weight / Density of Fabric: 285 gsm

285 gsm * 0.092903 (Conversion Factor) = 26.4774 Grams / ft2

Car hood rough dimensions: 65” x 48”

Square In” to Square ft’: (65”/12) * (48”/12) = 21.6667 ft2

26.4774 Grams / ft2* 21.667 ft2 = 573.67 grams of CF fabric

(1) Ply for skinning, so there is still a total of 573.677 grams of CF fabric that will need to be impregnated with resin. Accounting for a rough estimate of a Fiber to Resin ratio of a traditional layup with no vacuum bagging, a 50/50 ratio will be a safe bet and ensure underestimating is eliminated.

[(573.677 grams of CF fabric) * 50%] / 50% = 573.677 grams of resin

(No, the math wasn’t needed but practice makes perfect)

RESIN TO FIBER RATIO EXPLAINED

Resin needed: 573.677 grams

General Heavy Epoxy Density: .04734 g/oz

0.04734 g/oz * 573.677 g = 27.15 oz of mixed resin (50/50 Fiber to Resin Ratio)

Using a 4:1 fast hardener / epoxy stem, this skinning would fit using a quart of mixed resin.

For many basic applications, the math is going to result in the accurate numbers. As mentioned at the beginning of this post, planning is the key to success in composites. Spending the time to make ply templates, making layouts of the ply shapes and doing the math before the resin and fabric are bought are going to make the difference in making the proper selections. The more data that is gathered before buying, the greater chance at making a successful estimate on fiber and resin ratios.

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