

Resins Technical Information

Typical Viscosities at 25°C (Thickness of Chemicals)

Product	MPa.s
Nivitex - Gelcoat Brush	70,000
Nivitex - Gelcoat Spray	52,500
Nivitex - Poolcoat	32,500
General Purpose Resin	600
Low Viscosity Resin	300
Water	100

Resin Thixotropy

Definition

Low Shear Rate = High Viscosity
High Shear Rate = Low Viscosity

or simply

Liquid Stationary = Thick
Liquid in Motion = Thin

Arrhenius Approximate Equation

IMPORTANT TO KNOW: FOR EVERY 10°C RISE IN TEMPERATURE THE SPEED OF A CHEMICAL REACTION WILL DOUBLE e.g. ± 1°C increase in temperature is = to ± 10 minutes faster reaction or shorter work time.

Resin

The effect of temperature on the Gel Time

Catalyst - MEKP	Temperature	Gel Time / Work Time
2%	15°C	40 min
2%	20°C	30 min
2%	25°C	20 min
2%	30°C	15 min
2%	35°C	10 min

Catalyst Percentage Required to Achieve the Gel Time stated in the Data Sheet for eg. a GP Resin

Temperature	Catalyst
15°C	3%
20°C	2.5%
25°C	2.0%
30°C	1.5%
35°C	1.0%

Comparitive Strength

Tensile Strength

Glass	2,100 Mpa
Mild Steel	300 Mpa
Resin	80 Mpa

Physical Properties of GRP

Composite

Property	Unit	C.S.M.	W.R.
Specific Gravity		1.45	1.55
Glass Mass	%	30	40
Tensile Strength	Mpa	100	200
Tensile Modulus	Gpa	8	10
Flexural Strength	Mpa	150	210
Flexural Modulus	Gpa	7	8
Impact Strength	KJ/m ²	75	120
Coeff of Expansion	10E-6	30	20
Thermal Conductivity	W/mk	0.20	0.21

Physical Properties of GRP

Composite

Property	Unit	Cloth	Roving
Specific Gravity		1.75	2.00
Glass Mass	%	60	75
Tensile Strength	Mpa	350	1000
Tensile Modulus	Gpa	20	35
Flexural Strength	Mpa	450	1000
Flexural Modulus	Gpa	18	32
Impact Strength	KJ/m ²	130	-
Coeff of Expansion	10E-6	15	8
Thermal Conductivity	W/mk	0.25	0.37

Fundamentals

Prediction Of Thickness

One of the most important requirements in design is to relate the mass of material used with thickness that will be achieved. This information can be obtained from a knowledge of the thickness that each material will take.

Basic Data

	Density Mg/m ³	Thickness constant Thickness in mm attributable to 1kg/m ² of the material
Glass Fibre:		
'E' Glass	2.56	0.391
'S' Glass	2.49	0.402
'C' Glass	2.45	0.408
Polyester Resin	1.1 1.2 1.3 1.4	0.909 0.833 0.769 0.714
Epoxy Resin	1.1 1.3	0.909 0.769
Fillers - Calcium Carbonate	2.3 2.5 2.9	0.435 0.400 0.345

The thickness constants in the above values have been calculated from the formula
1 divided by the Density (Mg/m³) = thickness constant
***for any given density the thickness constant can be calculated**

Hence

Thickness of laminate (mm) = material mass (kg/m²) x thickness constant.

Example 1

A laminate consists of 600g/m² of 'E' glass fibre chopped strand matt and polyester resin (density of 1.2)
 At a resin to glass ratio of 2 : 1 by weight.

What will the thickness of the laminate be?

Thickness of glass = $6 \times 0.391 = 0.235\text{mm}$

Thickness of resin at 2 : 1 = $2 \times 0.6 \times 0.833 = 1.125\text{mm}$

Total thickness of laminate including resin and fibreglass = 1.360mm

Example 2

A laminate consists of 5 layers of 800 g/m² of 'E' glass woven roving at a glass content of 55% (density of resin = 1.3).

What will the thickness of the laminate be?

Resin to Glass ratio
= 100 - 55 divided by 55
= 45 divided by 55
= 0.818 divided by 1

* Mass of resin = 0.818 × 5 × 0.8 = 3.27kg
* Thickness of glass = 5 × 0.8 × 0.391 = 1.564 mm
* Thickness of resin = 3.27 × 0.760 = 2.514mm
Total thickness of laminate = 4.078mm

Example 3

A laminate consists of 1 layer of 300g/m² 'E' glass C.S.M and 4 layers of 600g/m²

The resin mix consists of 40 parts filler of density 2.5 Mg/m³ and 60 parts by weight polyester resin of density 1.2 Mg/m³.

Resin to glass ratio = 2 ½ : 1 by weight.

What will the thickness of laminate be?

Total mass of glass = 1 × 0.3 + 4 × 0.6 = 2.7kg/per m²
Mass of resin at 2 ½ : 1 = 2.7 × 2.5 = 6.75kg

Mass of filler = 6.75 × (40 divided by 60) = 4.50kg

* Thickness of glass = 2.7 × 0.391 = 1.056mm
* Thickness of resin = 6.75 × 0.833 = 5.623mm
* Thickness of filler = 4.50 × 0.4 = 1.800mm
Total thickness of laminate = 8.479mm

Some Useful Tips

Using 450 gm/m² CSM:

1 meter square CSM = 450gsm and uses approx. - 1 kg resin to wet out.
This will give a laminate approx. 1.2mm thickness and will weigh approx. 1.45kg per m².

Gel coat is applied at approx. 600g/m² and will result in a cured film of approx 0.5mm thick.

Catalyst additions:

In 1 litre resin - 1% catalyst = 10ml, therefore 2% = 20ml etc.
In 1kg resin - 1% catalyst = 10g, therefore 2% catalyst = 20gm.

As the density of resin and catalyst are fairly close, weighing of resin (kg) and then adding catalyst by volume (ml) or vice versa would be acceptable.

QUANTITIES OF MATERIAL FOR 1 SQUARE METRE OF MOULD

Item	Estimate	Production	Article
Polishing Cream	100g	100g	100g
Release Agent - Wax	10g	8.5g	7.5g
Release Agent - PVA	50g	40g	30g
Gel Coat - Clear	500g	470g	440g
Gel Coat - Pigmented	750g	630g	520g
Surface Tissue	1m ²	1m ²	1m ²
Resin in Tissue - Clear	300g	280g	265g
Resin in Tissue - Pigmented	450g	380g	310g
Glass C.S.M 2 x 450g/m ²	1000g	900g	900g
Resin in Glass Factor - Ratio	3.0	2.75	2.5
Glass W.R. 625g/m ² - Ratio	700g	625g	625g
Resin in Glass Factor	2.0	1.75	1.5
Catalyst	2% (Resin + Gel Coat	2% (Resin + Gel Coat	2% (Resin + Gel Coat
Brushes & Rollers	Consumables	Consumables	Consumables
Cleaning - Acetone	Consumables	Consumables	Consumables
Labour	Time	Time	Time
Conatiners	Consumables	Consumables	Consumables

App. Gel Times for Variable Temperature and Catalyst Additions

Temperature	Catalyst Percentage				
0°C	1.00%	1.50%	2.00%	2.50%	3.00%
35°C	20 min	15 min	10 min	8 min	6 min
30°C	30 min	22 min	15 min	12 min	9 min
25°C	40 min	30 min	20 min	16 min	13 min
20°C	60 min	45 min	30 min	23 min	16 min
15°C	80 min	60 min	40 min	30 min	20 min

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