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GUIDE TO PREPREGS

A prepreg consists of a reinforcement material preimpregnated with a resin matrix in controlled quantities. The resin is partially cured to a B-stage, and in this form is supplied to the fabricator, who lays up the finished part and completes the cure with heat and pressure. The required heat and pressure will vary with the resin system and the intended application.

ADVANTAGES OF PREPREGS VS WET LAY UP

- Low void content
- Control of fibre volume fraction
- Control of laminate thickness
- Lower labour cost
- Better quality and conformity
- Clean process

PROCESSING TECHNIQUES

- Vacuum bag moulding
- Autoclave moulding
- Press moulding
- Pressure bag moulding
- Thermal expansion moulding
- Tube rolling

PROCESSING PARAMETERS

The cure cycle is the process whereby the resin within the prepreg changes from a liquid to a solid through the application of heat. There are a number of stages in this cycle.

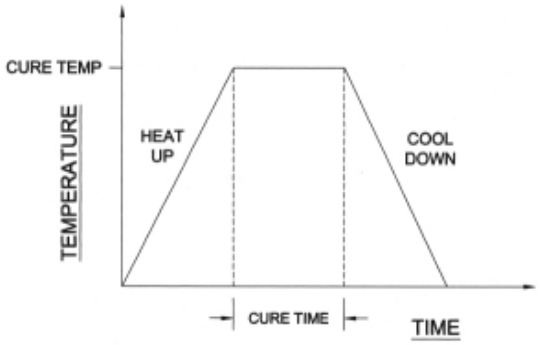
Cure Temperature / Time

For each prepreg resin system there is a range of options for cure temperature / duration. There is also a minimum cure temperature. For a given cure temperature there will be a corresponding cure time. The oven/autoclave, laminate, and tooling should all reach and maintain the given cure temperature throughout the specified cure cycle. Thermocouples are used to monitor the temperature of the laminate and tooling.

Heat Up Rate

The heat up rate is a measure of how quickly the laminate / tool is brought up to the cure temperature. This is governed by numerous factors;

- matrix viscosity
- matrix reaction rate
- thickness of laminate
- tool mass
- tool conductivity



For highly reactive matrices and thick laminates the heat up rate will be low, and may incorporate an intermediate temperature soak, in order to avoid exothermic reactions.

Cooling Rate

The cooling rate is controlled in order to avoid sudden temperature drops that may induce thermal stresses in the component.

Vacuum / Pressure

At specific stages in the cure cycle, vacuum and pressure are applied and removed.

PREPREG NOMENCLATURE

The following terms are commonly used when discussing prepregs;

Fibre areal weight (FAW)	weight of the fabric used in a prepreg
Fibre volume fraction (V_f)	percentage of fibre in the prepreg (by volume)
Flow	ability of a resin to move under pressure, allowing it to fill all parts of a laminate
Gel time	the time required at a given temperature for a resin to progress from a liquid to a solid, indicated by a rapid increase in resin viscosity
Glass transition temperature (T_g)	temperature at which a phase change occurs in the matrix, this gives an indication of the maximum end use temperature
Resin weight (RW)	percentage of resin in the prepreg (by weight)
Shelf life	the length of time the prepreg can be stored under specified conditions and continue to remain suitable for its intended function
Tack	measurement of the capability of an uncured prepreg to adhere to itself and to mould surfaces

Tack life	the length of time the prepreg can be stored at room temperature (21°C) and continue to have sufficient tack
Viscosity	measurement of the flow characteristics of a resin, influenced by temperature and heat up rates
Void content	percentage of voids in a cured laminate (by volume)
Volatiles	materials, such as water or solvents, that are capable of being driven off as vapour at room or elevated temperatures

STORAGE AND SAFETY

Prepregs should be stored, wrapped and sealed in polythene at -18°C for maximum shelf life. The material must be fully thawed before breaking the polythene seal in order to avoid moisture contamination.

Prepregs are low risk in terms of handling hazards, however the usual precautions should be applied. Gloves and protective clothing should be worn. Use mechanical exhaust ventilation when heat curing prepreg systems.

Further information, including product data sheets, can be obtained from;

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