

What is B-Stage?
and
How do they do it?

How are Pre-impregnated
composites material manufactured

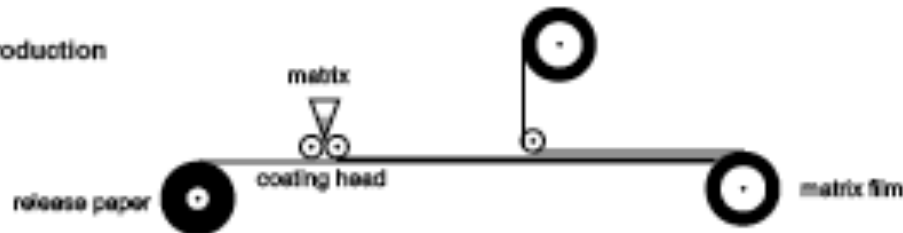
Typical Prepreg Manufacturing Processes

- Hot Melt
 - Solid resins are melted, cast onto release paper and then in a 2nd process are sandwiched over the reinforcement.
 - Degree of cure “mainly” controlled by the resin supplier
 - Some additional cure (B-staging) occurs during the process
- Solution
 - Solid and liquid resins are dissolved in solvents
 - Reinforcement is drawn through the resin tank
 - Solvents are evaporated away in an oven
 - Additional B-staging occurs in the oven

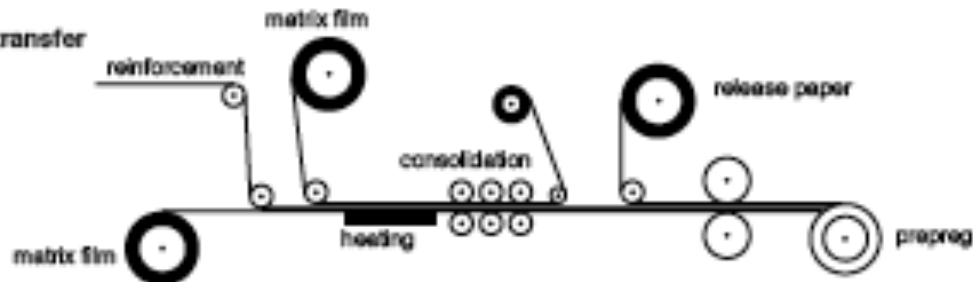
Typical Hot Melt

Film transfer route : 2 steps process

Step 1 - Film production



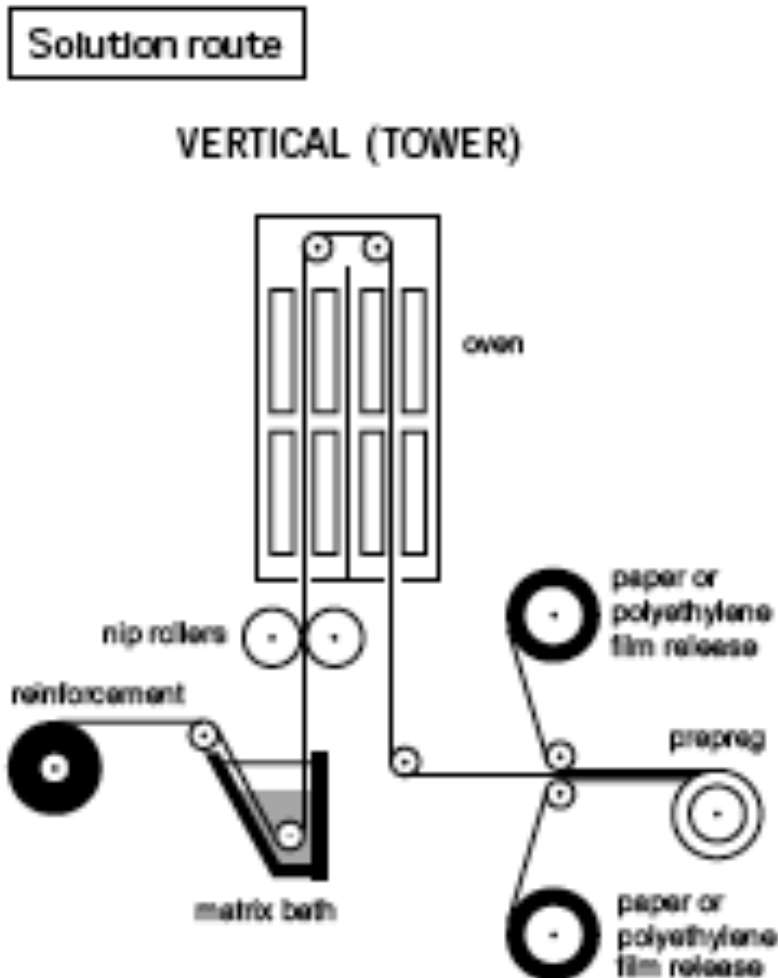
Step 2 - Film transfer



- Two step process
 - Melt and mix resins
 - Reverse roll-coat thin layer of resin on to the release paper
 - Paper with resin is then delivered the next step.

- Reinforcement is “sandwiched” between two layers of resin/paper
- Heater softens resin enabling impregnation
- Consolidation rollers “work” the material aiding impregnation

Typical Solution



- High viscosity epoxy's
 - Typically solid at room temperature
 - Dissolved in a solvent, usually acetone
 - Placed in the “matrix bath.”
 - Nip Rollers “squeeze-out” excess resin, controlling resin content
- Ovens
 - Drive off/out all solvents
 - The solvents can be reclaimed and recycled
 - B-Stage (partially cure) the epoxy resin
- Polyethylene film releases
 - Only required if the material is sticky/tacky

B-staging of toughened epoxy composites

by

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Elgin Bravo

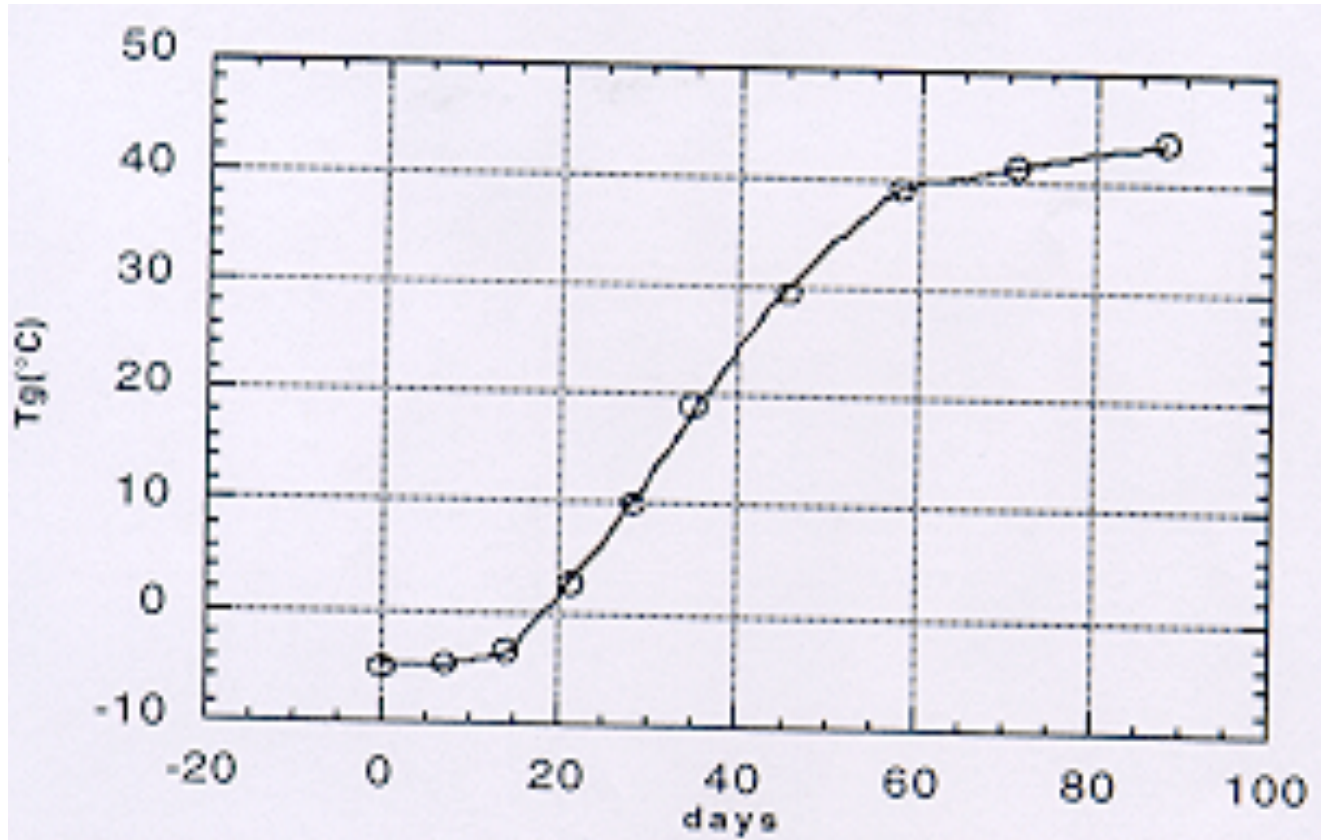
February 09, 2001

Definition of B-staging

- To cure an epoxy to a pre-determined degree of chemical conversion.

<u>Stage</u>	<u>° Chemical conversion</u>
• Green	0
• B-stage	<0.29
• C-stage	<0.90

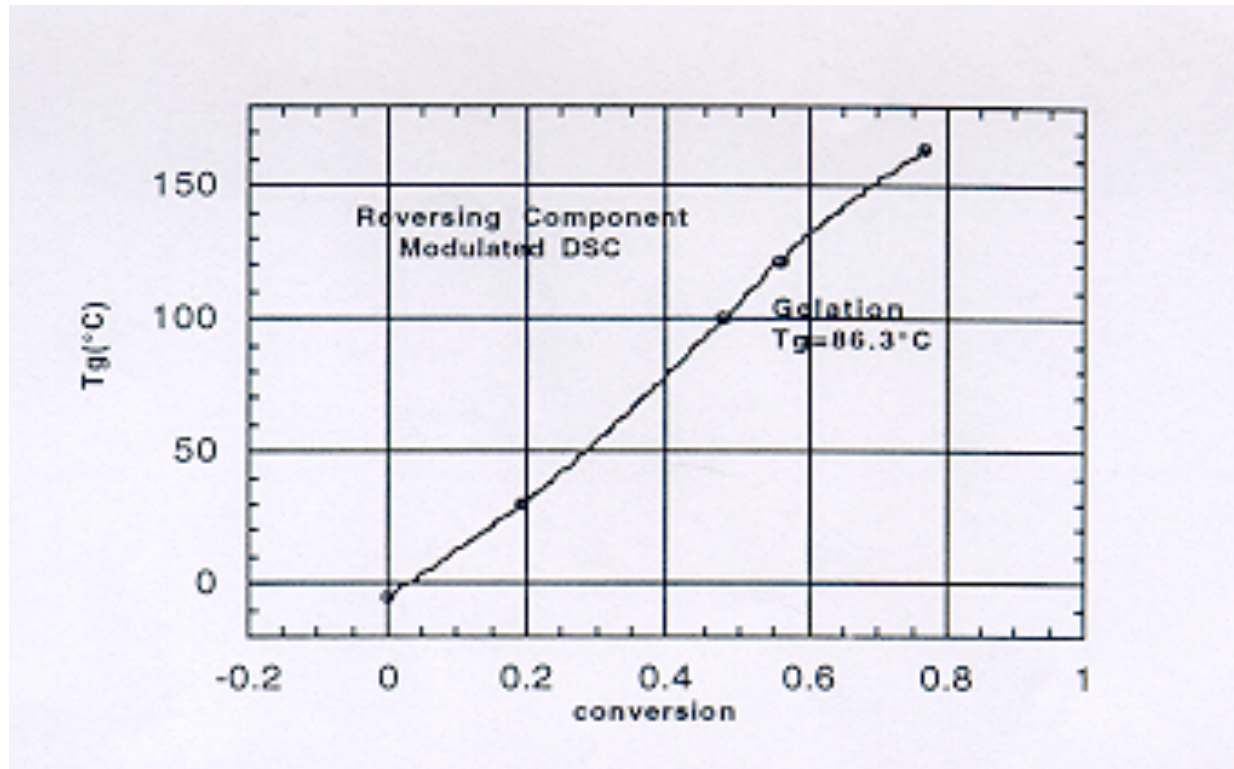
Tg of green epoxy at 23°C



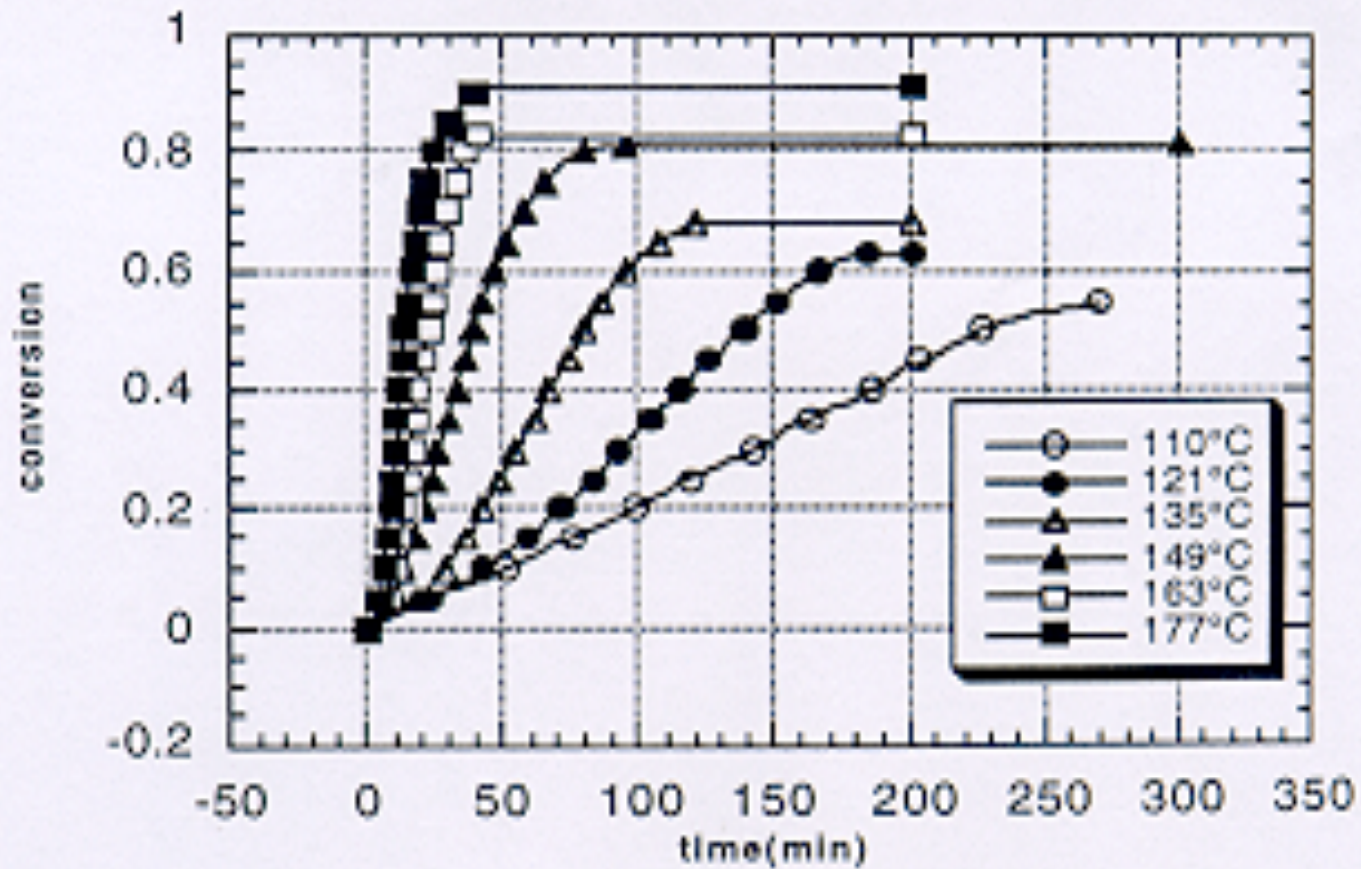
$$T(t) = T_0 + Bt$$

$$dQ/dt = C_p B + f(t, T)$$

Tg as a function of conversion



Conversion and Isothermal cure



Shimadzu's CFT Flowtester is a constant shear stress type capillary rheometer used mainly for the collection of viscosity data and its effect on various types of polymers.

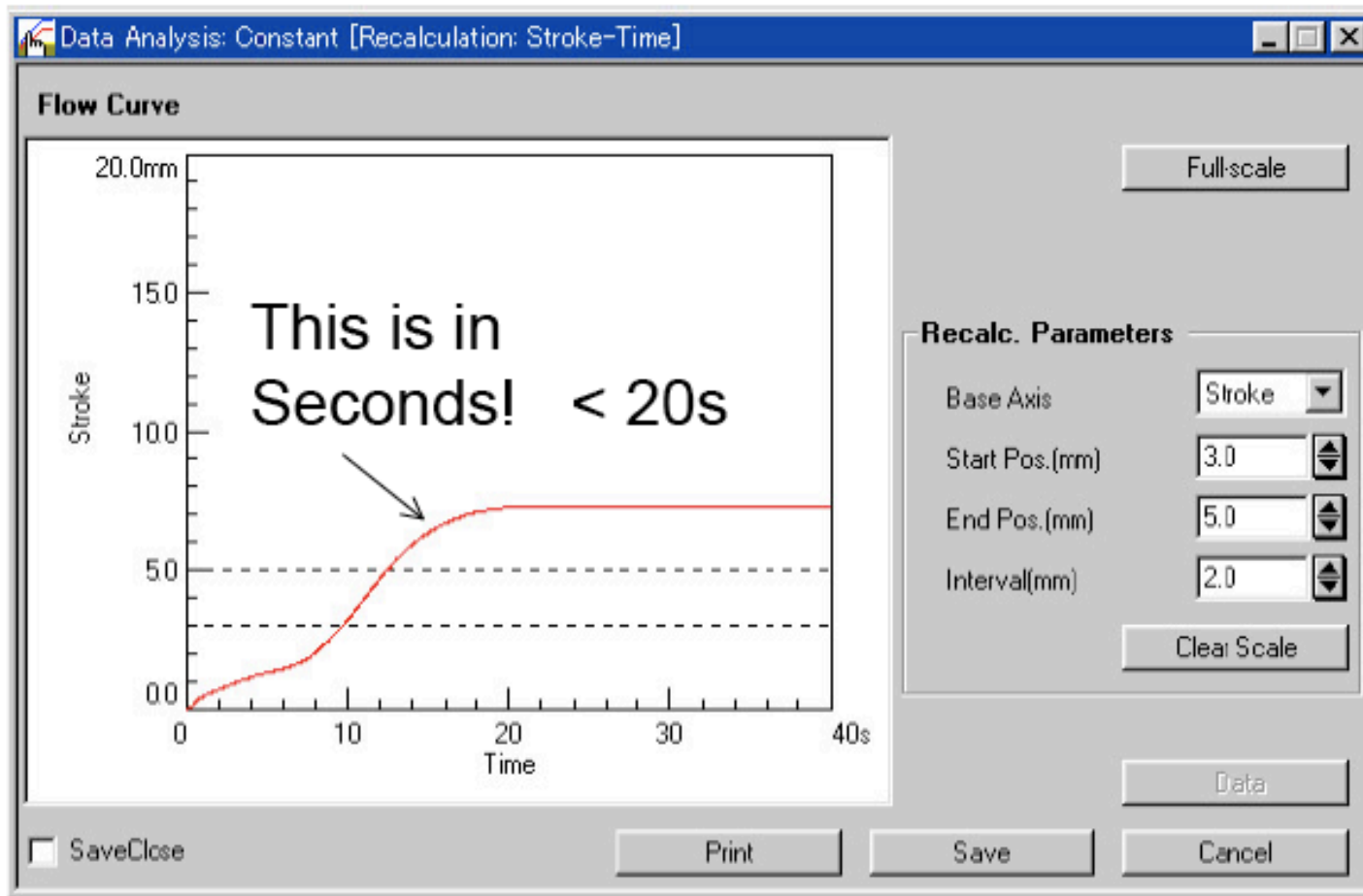


Fig.3: Flow curve of epoxy tested under 165°C
Shimadzu (2010)