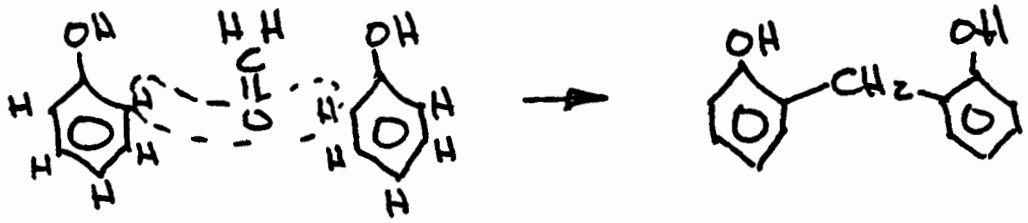
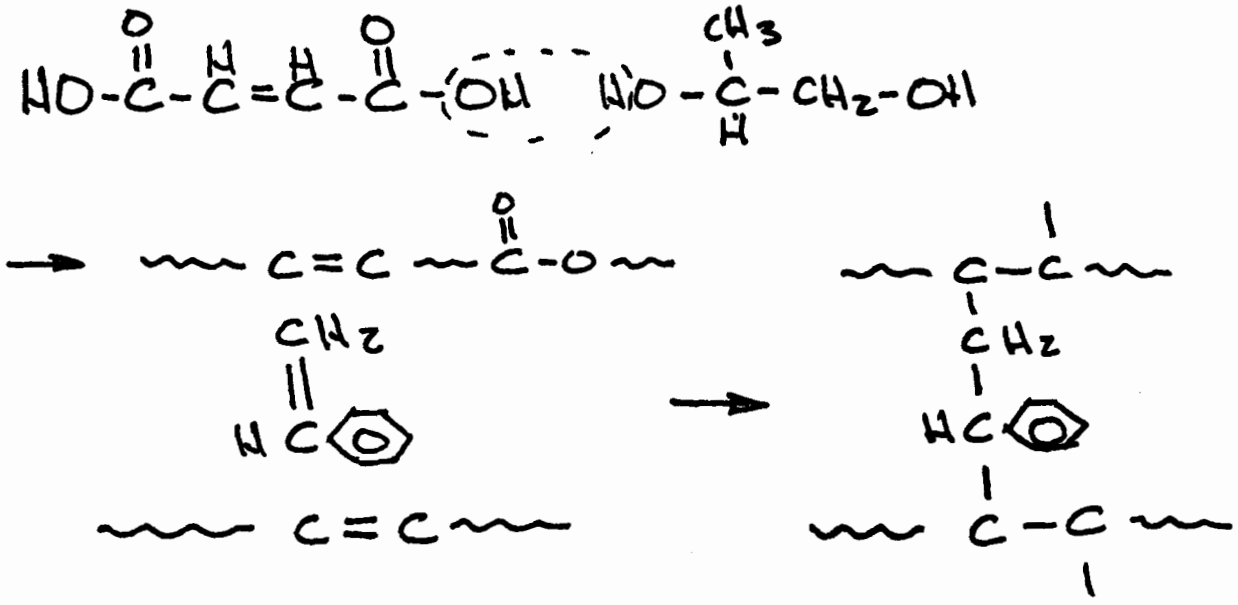
Thermosetting Resins

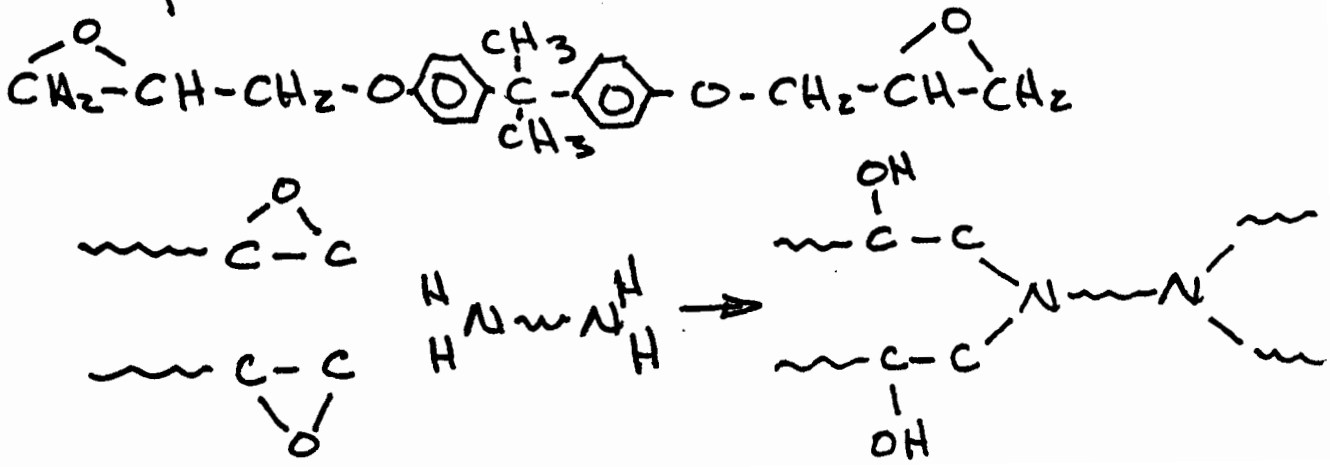
- phenolics

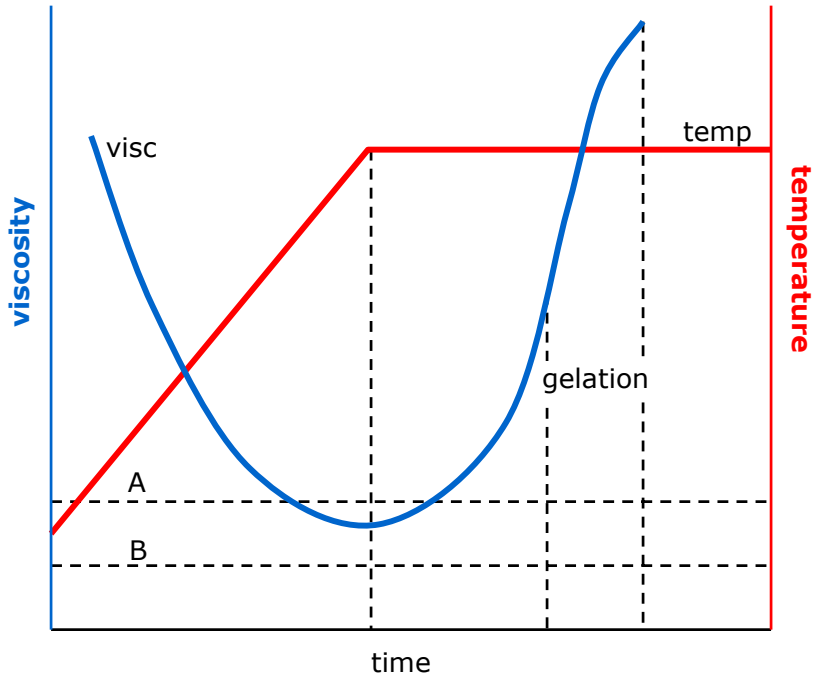


- Unsaturated polyesters

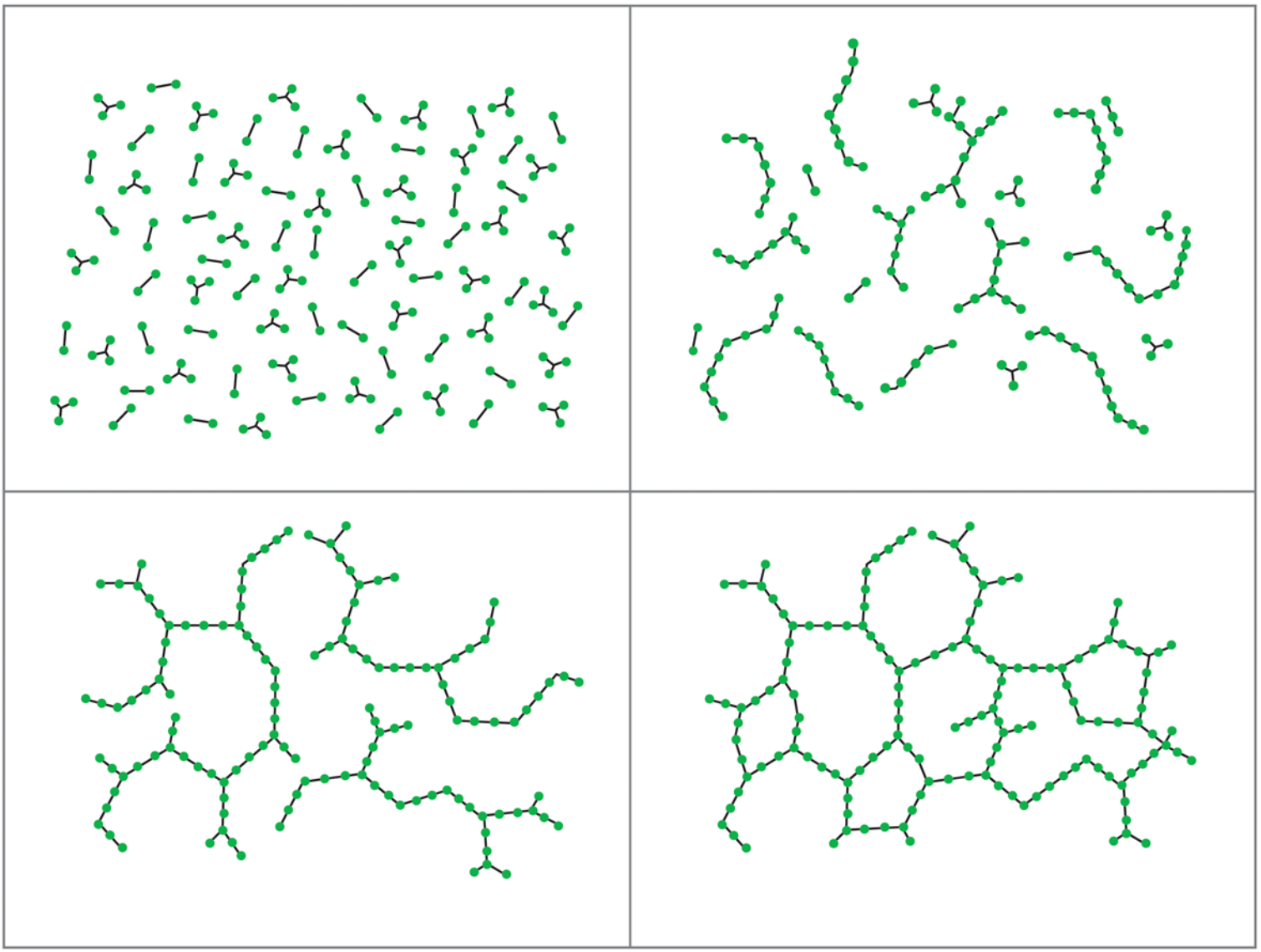


- epoxy eg DGEBA





Epoxy curing



Cure kinetics

$$\frac{d\alpha}{dt} = k_0 \exp\left(\frac{-E^r}{R_g T}\right) \cdot \alpha^{m1} (1-\alpha)^{m2}$$

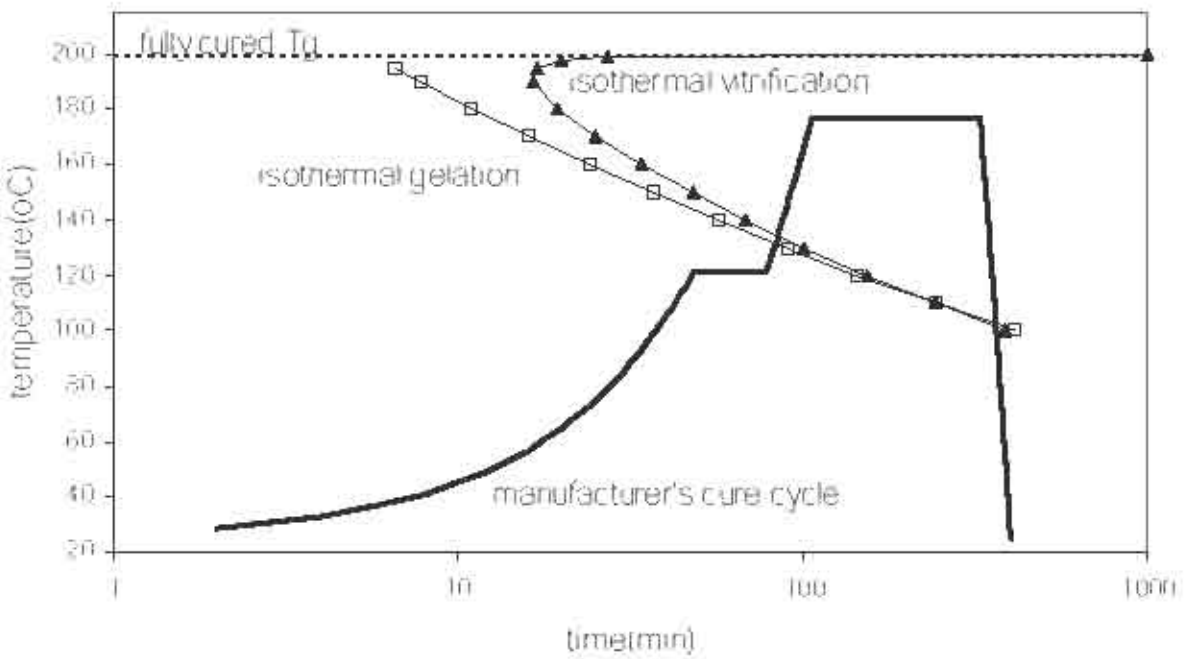
Gelation:

$$\alpha_{gel} = \frac{2}{f_{avg}}$$

Glass transition temperature:

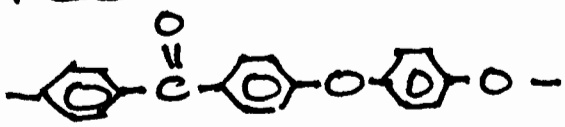
$$T_g = \frac{(1-\alpha) T_{g0} + \lambda \alpha T_{g\infty}}{(1-\alpha) + \lambda \alpha}$$

Time-Temperature-Transformation (TTT) Diagram:



Thermoplastic Resins

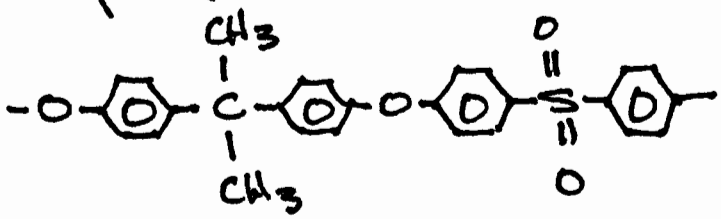
- Features
  - damage tolerance ("CAI")
  - hot / wet compression
  - solvent resistance (crystallinity)
  - shelf life
  - difficulties in impregnation
- Examples
  - PEEK (ICI)



$T_g = 143°C$

$\eta_{400C} = 1000\ Pa \cdot s$

  - Polysulfone (Union Carbide Udel P1700)

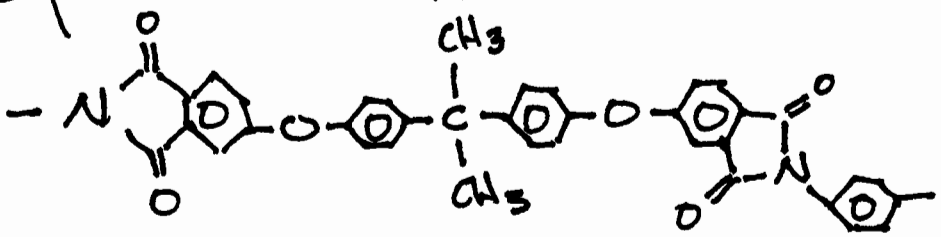


$T_g = 190°C$

$\eta_{240C} = 10^5$

$G_{1c} = 3200\ J/m^2$

  - Polyetherimide (GE Ultem)



$T_g = 220°C$

$\eta_{305C} = 10^5$

$G_{1c} = 3400\ J/m^2$