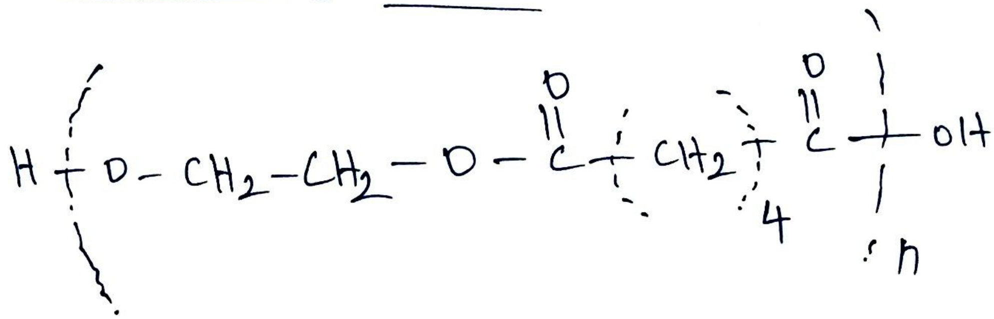
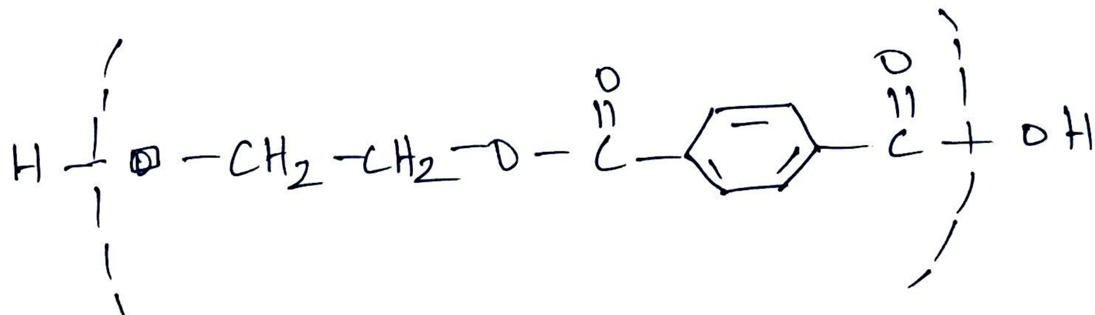
Factors Affecting T_g

① Stiffening Group



Poly ethylene Adipate $T_g = -70°C$

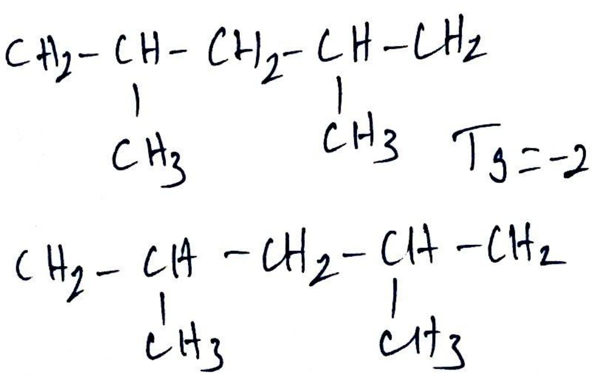


Poly ethylene Terephthalate

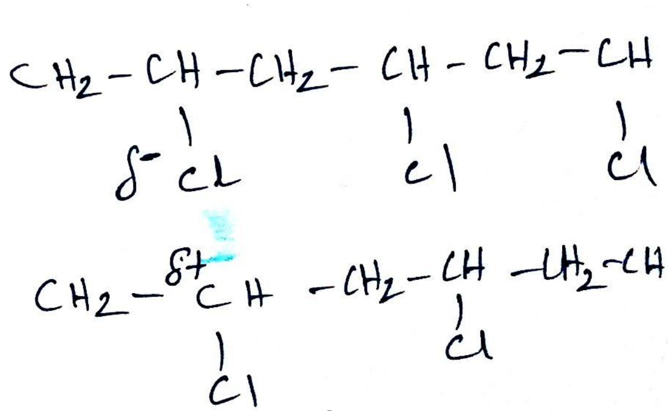
$T_g = 69°C$

② Intermolecular Forces

— Dipole-Dipole

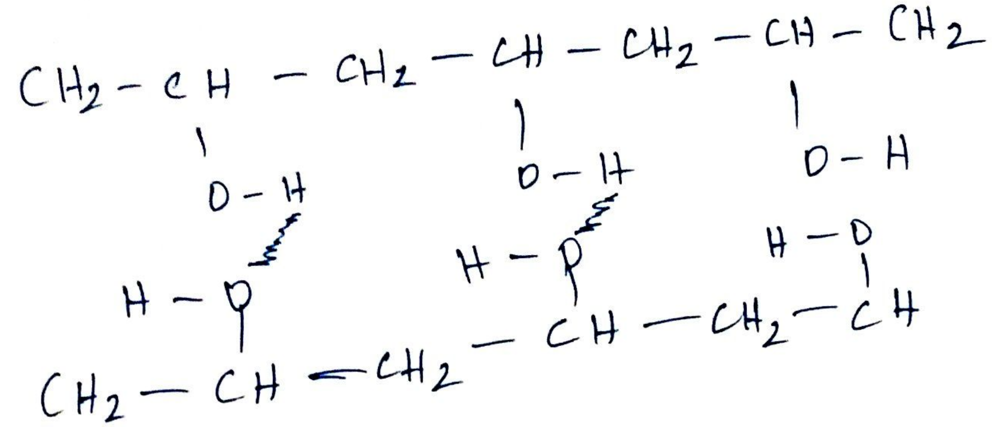


$T_g = -20°C$



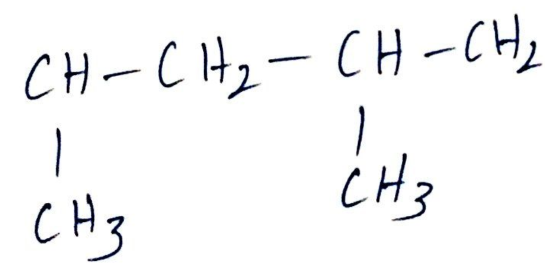
$T_g = 81°C$

H-Bonding



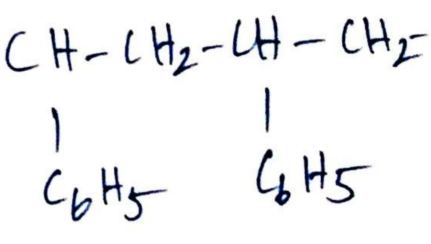
T_g = High

③ Pendant Groups



Aliphatic

$T_g = -20°C$



poly styrene

$T_g = 100°C$

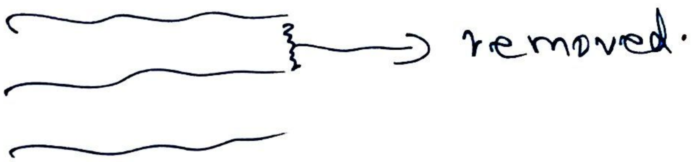
④ D_p - Degree of polymerization

High-D_p - longer chain - Folded entangled

- Amorphous → less T_g

(5) Plastisizer

Low M. wt Compound added to increase Flexibility



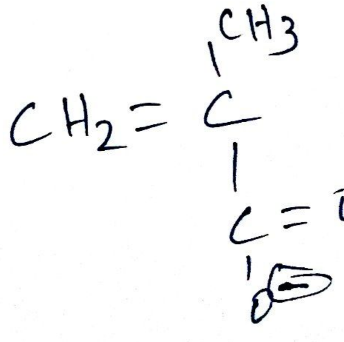
Adding plastisizer → Decrease Tg

(6) In terms of flexibility

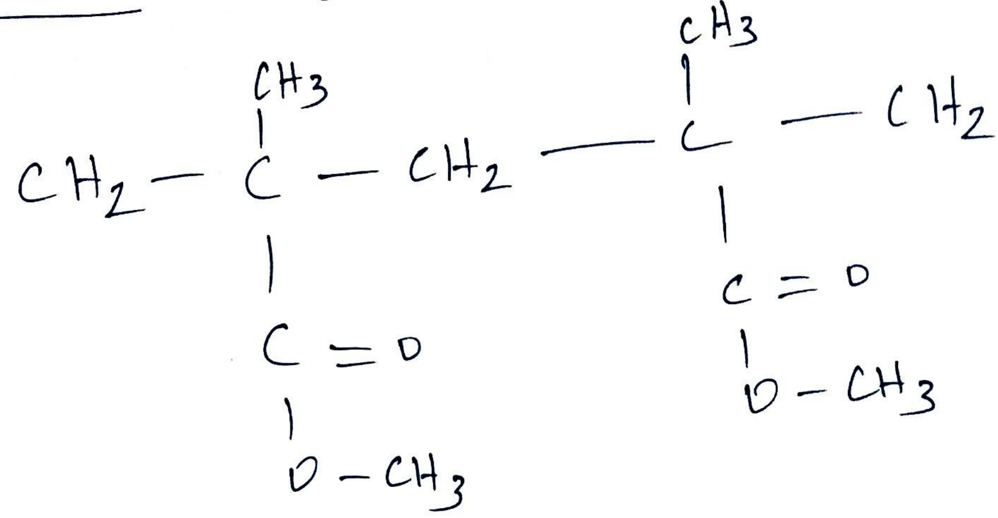
Poly methyl metha Acrylate – PMMA

Poly Butyl metha Acrylate – PBMA

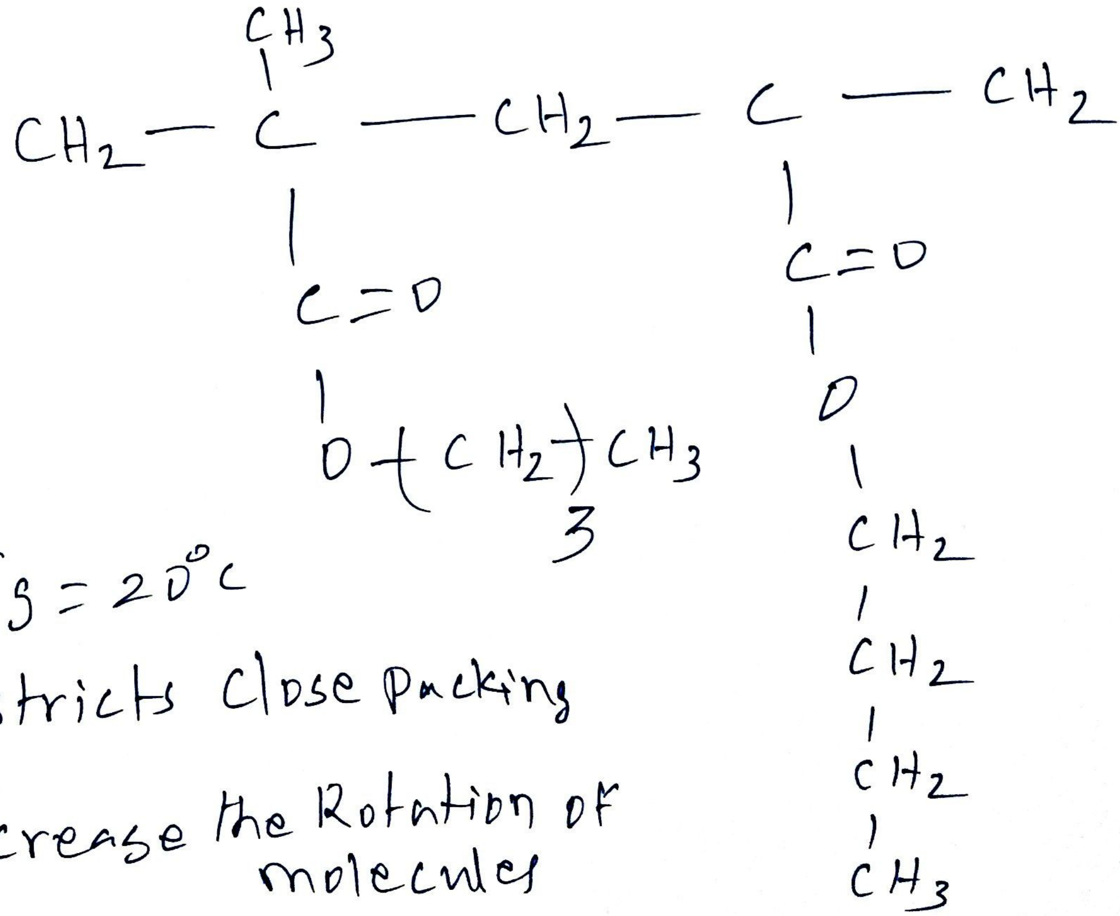
metha Acrylate



PMMA Tg - 105°C



PBMA



Tg = 20°C

Restricts close packing

Increase the Rotation of molecules

Less intermolecular Forces
Less Tg

Differential Scanning Calorimetry

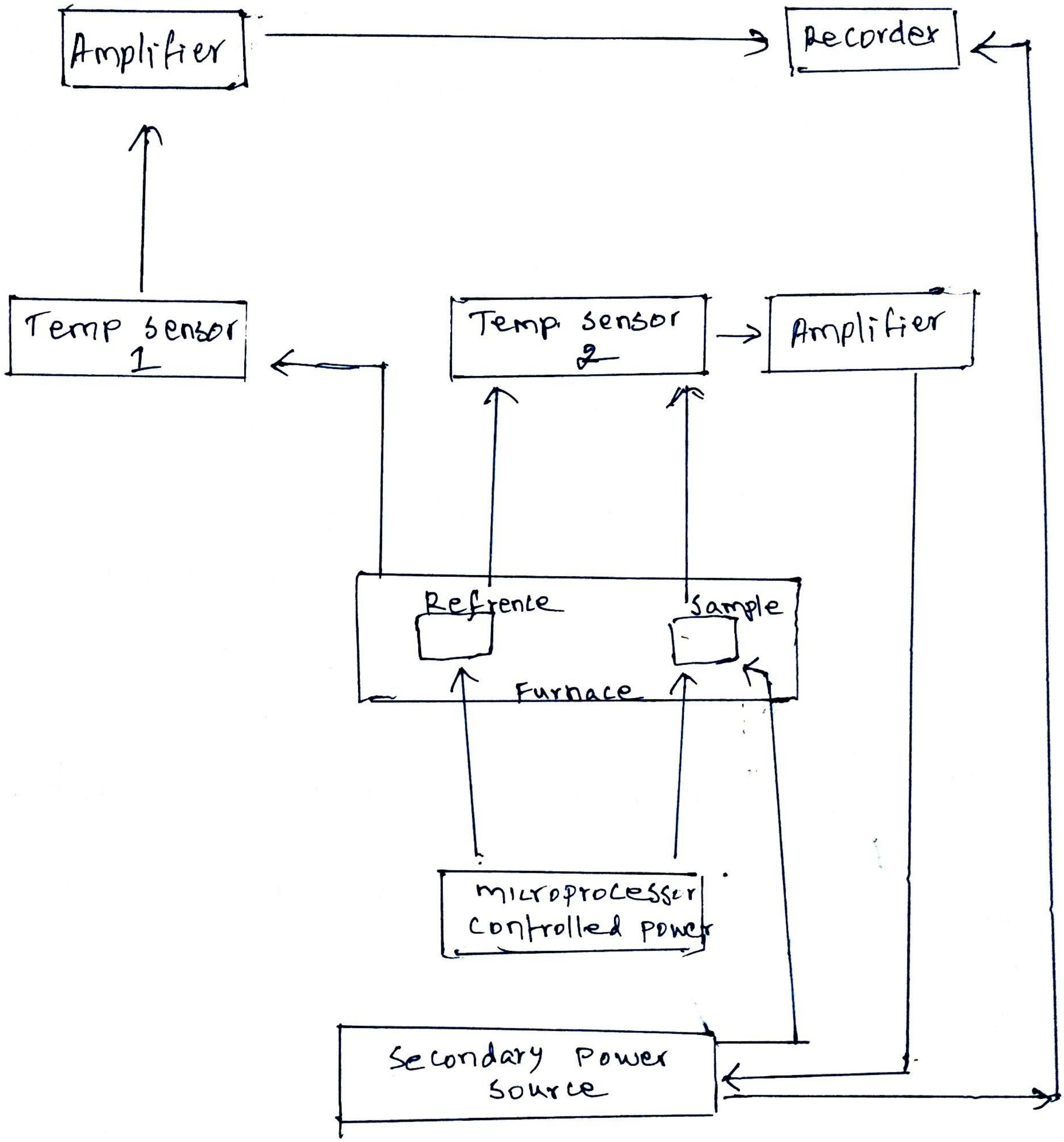
Property polymer w.r.t Temp.

3 - terminologies

1. M. Pt (T_m)
2. ~~B.Pt~~ Glass Transition Temp (T_g)
3. Crystallization Temp (T_x)
   - The temp at which crystallization starts

T_m, T_g - Lower $\rightarrow$ Higher T - Endothermic

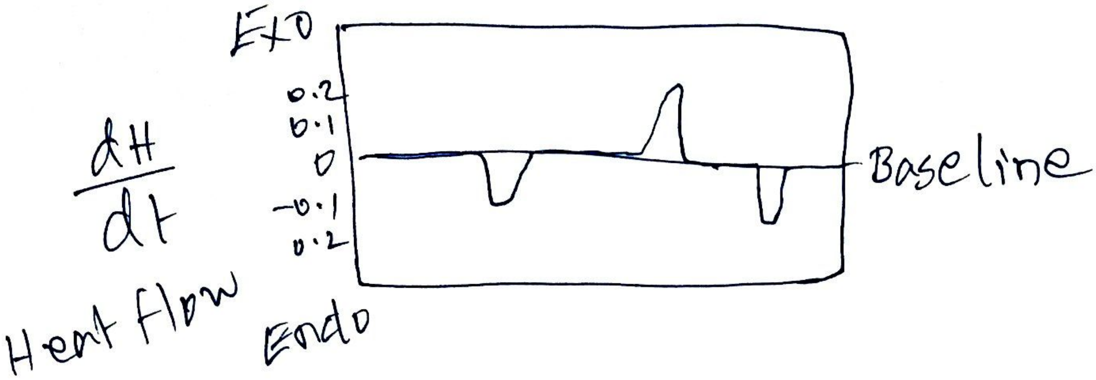
T_x - Higher $\rightarrow$ lower - Exothermic



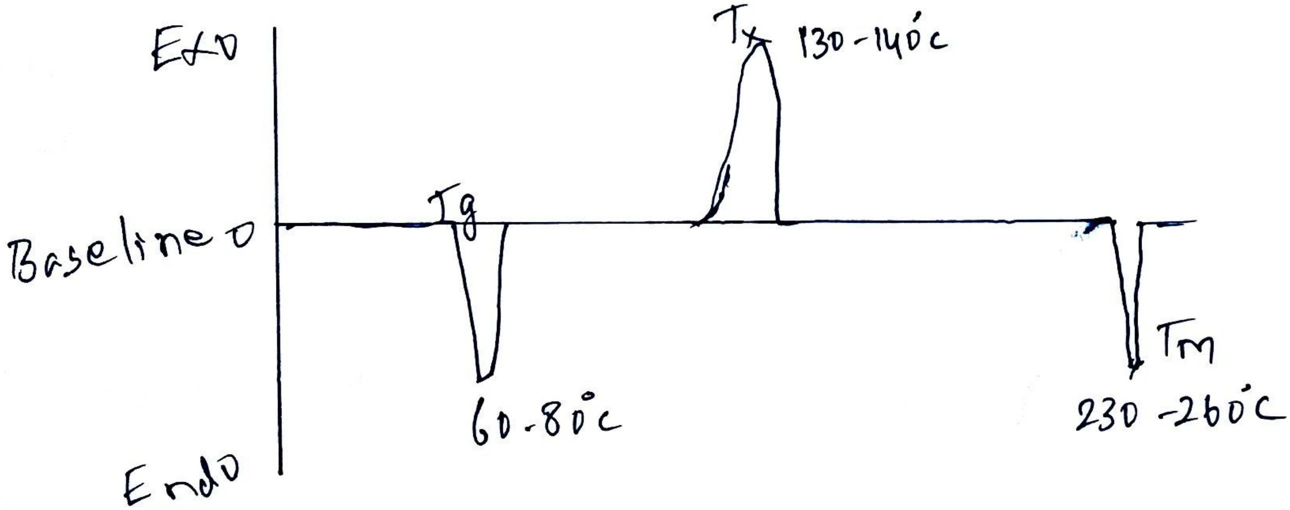
Reference - Al_2O_3 (Thermally inert) - T_R

Sample - T_S

$$\Delta T = T_S - T_R$$



A Typical DSC for PolyEthylene Terphlthalate
PET



Above the Tg - crystallization

mobility | Rotation of molecules

Crystallizable polymers

$\left.\begin{matrix}\text{The area of the}\\ \text{peak}\end{matrix}\right\} \propto$ Enthalpy change

Heat / Enthalpy change of T_g, T_m, T_x – measured

$$\% \text{ Crystallinity} = \frac{\Delta H_m - \text{sample}}{\Delta H_m - \text{Pure crystallin standard}} \times 100$$

T_{rg} = Reduced Glass Transition Temp.

$$T_{rg} = \frac{T_g}{T_m}$$

Glass forming ability can be found using rate of cooling Temp.