Recycle No:-

Number	Name
01	PET [Poly ethylene Teriphylate]
02	HDPE [High Density Poly ethylene]
03	PVC [Poly Vinyle Chloride]
04	LDPE [low Density Poly ethylene]
05	PP [Poly Propylene]
06	PS [Poly Styrene]
07	Other [PMMA, ABS, SAN etc.]

- **Polymer :-** Polymer is a high molecular weight Compound form by the Combination of Small molecule of low molecular weight.

OR

The Process by which monomer Combine to form Polymer in known as Polymerization.

The Number of repeating units present in it Call Degree of Polymerization.

Exp → $n\ CH_2 = CH_2 \longrightarrow [CH_2 - CH_2]$

- **Adition Polymerization :-** when molecules just add on to form the Polymer without elimination of any molecules the process is called adition Polymerization.

In adition Polymerization the molecular weight of the Polymer is roughly equle to that of all the molecules which Combine to form the polymer.

Exp →

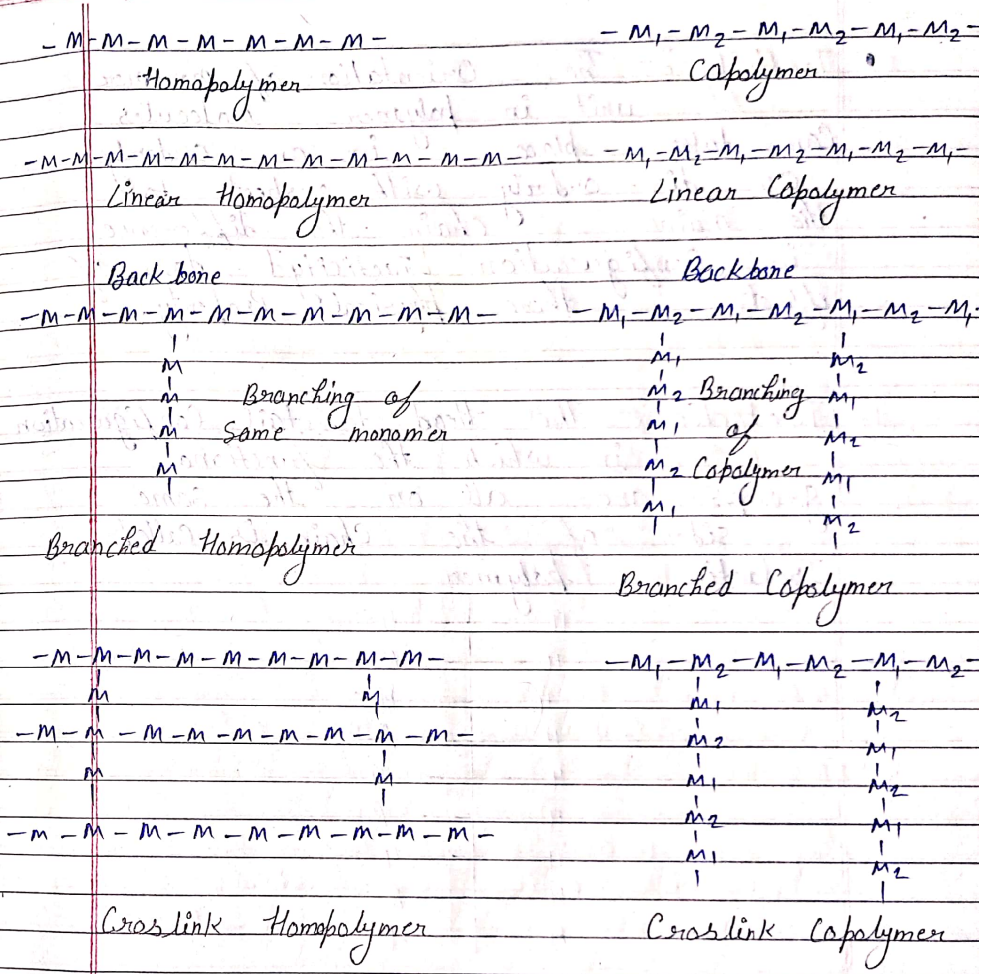
Polyethylene.

- Condensation Polymerization :- When molecules combine with elimination of single molecules like water etc. The process is called Condensation Polymerization.

The molecular weight of Polymer is lesser by the simple molecules eliminated during the Condensation Process.

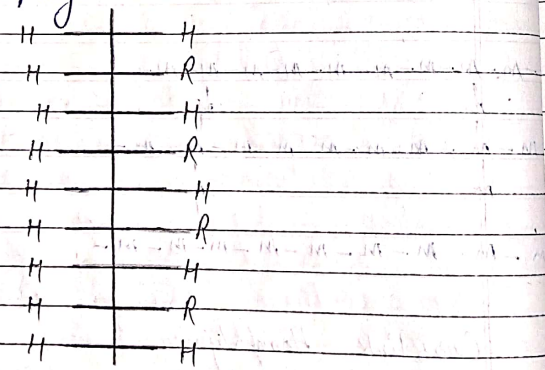
- Types of Polymer :- A polymer Consists of Identical monomers or monomers of Different Chemical structure are called Homopolymer and Co-Polymer Respectively if the Chain is made up of some species of atoms the Polymer Homochain Polymer.

Graft Co-Polymer are branched structures in which the monomer sigments on the branches and back bone differ as shap shone in figure.

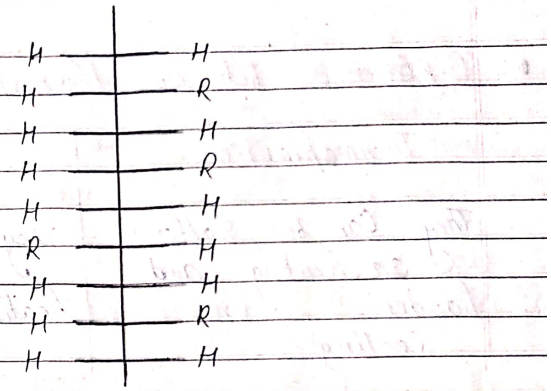


- Tacticity :- The Orientation of monomer unit in polymer molecules Can take place in an orderly or dis-orderly with respect to the main chain the difference in Configuration [Tacticity] does of effect there physical Property.

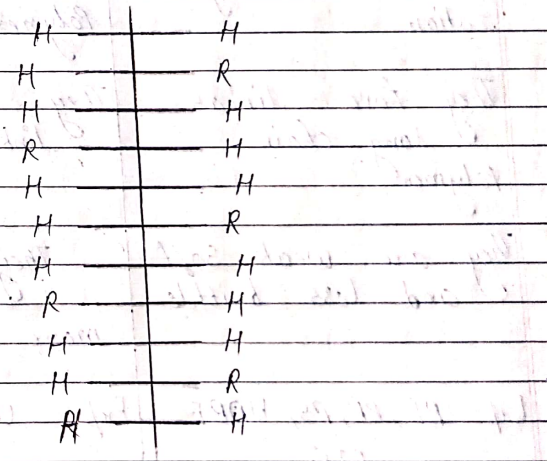
1) Isotactic :- The Head to tail Configuration in which the functional groups are all on the same side of the Chain is called Isotactic polymer.



2) Atactic :- If the arrengment of functional group are randome around the main Chain it is Call Atactic Polymer.



3) Syndiotactic :- If the arrengment of functional groups in alternating fa then it is called Syndio Polymer.



∴ where R is Functional group.

- Difference between thermoplastic and thermoset

Thermoplastic	Thermosetting
They Can be Soften on heating and harden on Cooling	They Cannot be Soften on heating
They Reshaped or Remould	They Can't Remould
They form by addition Polymerization	They form by Condensation Polymerization.
They have linear long chain Polymer	They have 3D Cross link network.
They are weak, Soft and less brittle	They are hard, Strong and more brittle.
Exp- PE, PP, PS, HDPE etc.	Exp- UF, MF, PF etc.

- Engineering Thermoplastic :- The Thermoplastic material which has the a capasity to withstand tensile pressure of more then 400 Kg/cm² and Temperature more then 100 °C under specified fiber stress in Continuous use are consider as Engineering Plastic.

They are capable for being form or shaped to precise the stable dimentions.

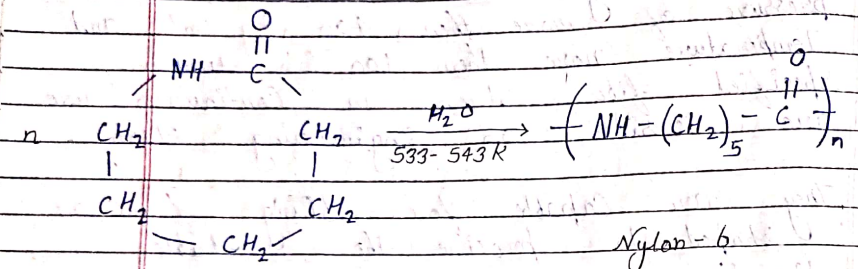
The Polymer like - Nylon-6, Nylon-66, PET, PBT, PC, PPO, represent this group of Plastic.

Crystaline	Amorphous.
• PET	• PC
• PBT	
• POM	
• PPO	
• Nylon-6	
• Nylon-66	

Crystaline - Hard and brittle.

Amorphous - Soft and flexibale.

Nylon 6



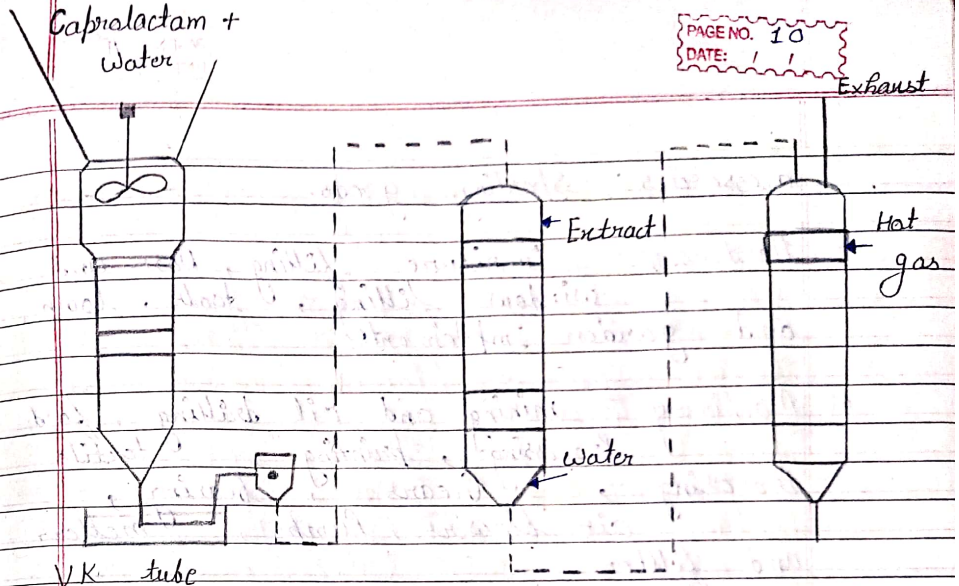
Nylon-6

ε-Caprolactum

Nylon 6 is synthethyzed by using ring opening polymerization of Caprolactum

Caprolactum has 6 carbon hence Nylon 6

When Caprolactum is heated at about 533 K in a Inerd atmosphure of hydrozen for about 4 to 5 hours. The ring bracks and under gase polymerization



Applications of Nylon 6, 66 -

- Automotive - Power Plant, electrical Parts, Fule system, Heating Ventilation, Chassis Part, Air Conditioning, Decorativ Body Part.
- Electrical - Switches, telephone Parts, Industrial Controls, wireing associated devices.
- Appliances - Cooling equipments, Cooking equipments, sewing machine, dishwasher, House Cleaning equipments.
- Consumer Products - Toys, film for Cooking, Brush, personal

accesories, sporting goods.

- Hardware - Furniture fitting, Door and window fitting, tools, lawn and garden Implements.
- Machinary - mining and oil drilling, food processing, printing, textile processing, Gears, bearing, air blowers, Pumps, metters and filter.

Properties of Nylon 6 :-

- Tensile Strength — 80 mPa
- Tensile modulus — 300 mPa
- Water absorption — 3.0 %
- Hardness — M 86
- melting Point — 220°C

- They are tough
- Has well elasticity and lustre
- Good Chemical Resistance
- Good electrical insulating Properties
- High mechanical Strength.

Nylon 66

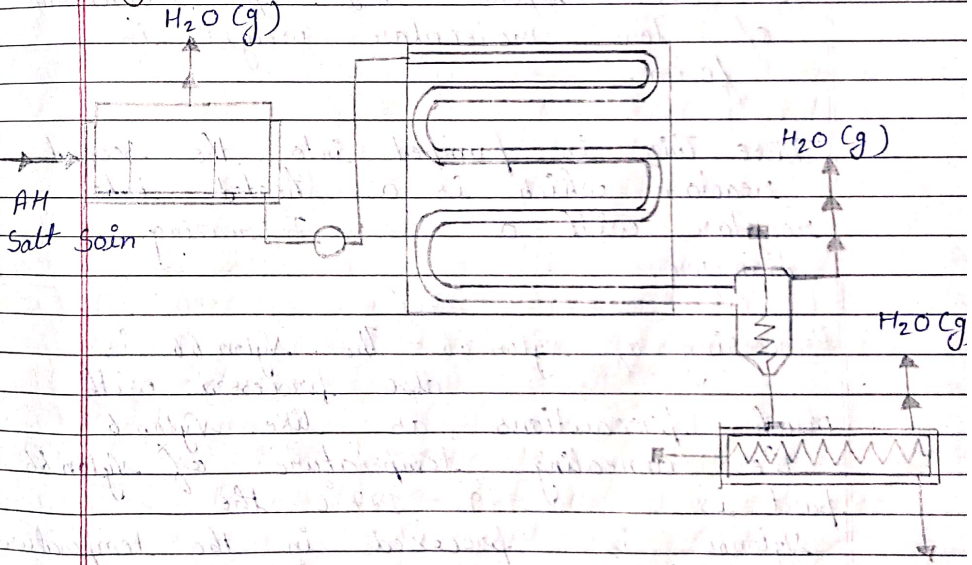
$$HOOC-(CH_2)_4-COOH + H_2N-(CH_2)_6-NH_2$$

Adipic acid — Hexamethylene diamine

$$\xrightarrow{-H_2O} \left(\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-\overset{H}{\overset{|}{N}}-(CH_2)_6-\overset{H}{\overset{|}{N}}\right)_n$$

Nylon 66

Polymerization -



Polyemide 66

Polymerization of Nylon 66 is Caried out in several different reactors Connected in series as shown in above figure the starting material is an equa solution of Nylon Salt Containing equivalent quantities of Hexa methylene diamine and adipic acid. The Solution with about 60% Solid Containt is feed in to the first horizontal Cylendrical reactor then devided into several Components. Where the water driven of as vapour and pre Condensate of low molecular weight in form.

~~These~~ This is pumped into the second reactor which is a heated tube reactor with a Increazing diameter.

Processing of Nylon 66 - The Nylon 66 is also processed with much precautions as like Nylon 6 the annealing temperature of Nylon 66 part is 149 - 177°C the Nylon66 is processed in the temperature range of 275 - 305°C.

Properties of Nylon 66 :-

- Tensile strength 90 mPa
- Tensile modulus 3400 mPa
- Water absorption 2.8 %
- Hardness M 90
- melting Point 255 °C

- High mechanical Strength
- High toughness, stiffness and hardness
- Good Impact Resistance.
- Good electrical Insulating Properties
- High water absorption.

★ Glass Transition Temperature - The temperature below which a Polymer Hard and above wich it is soft is called the glass transition Temperature.

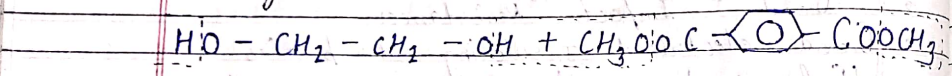
The Hard and britill state is known as glassy state and the soft flexibale state is known as Rubbery viscas state.

Glassy state (Britill Plastic)	Rubbry or viscoelastic state (Tough Plastic Rubber)	viscafluid state. (Polymer melt)
	T_g	T_F

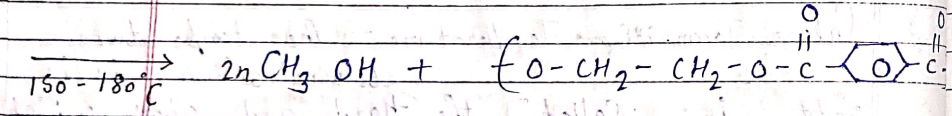
P.E.T.

Poly ethylene terephthalate

The PET Polymer is produce by the reaction of ethylene glycole and Terephthylic acid or di methyl teri thylate in the presence of methyl acetate Catalyst. the method is call "easter exchange Process".



ethylene glycole Tripthylic acid



PET

In this Process a low molecular weight di-ester known as the monomer is first Produced by reacting di-methylene terephthalate (1 mol) with (about 2.1 to 2.2 mol) ethylene glycole at 150°c in the presence of Catalyst such as "Antimony try oxid and "Cobalt : acetate"

methynol form during the Condensation is remove using a distilation Column.

Manufacturing of PET [Continuous Process] -

PET Polymer are Produce by eighter a semi batch or Continuous Process a shown in diagram in this process TPA is used as a row material TPA and EG are fead directly into the slury mixing tank.

The mol ratio of EG and TPA is approximatly equal the slury fead to the Steryfication stage which consist of two reactor virang in series for the poly Condensation

three reactor are used.

Properties of PET -

Out standing chemical resistance
Water ~~Repellent~~ Repellent.
Sterilizable by x-Ray, ethylene oxide.
Good electrical Properties.
Good Tensile strength.
Excellent dimensional stability.
Good Impact strength even at low temp.
High Tear strength.
Flame Resistance
Heat Resistance
Out standing Clearity
High gloss.

Processing of PET - PET can be processed by following technique

- Injection moulding
- Stretch Blow moulding
- Thermoforming
- Extrusion machine.

The PET available in the following grad

- Glass fild grade.
- Injection moulding grade

- Extrusion grade
- Stretch Blow moulding grade.

Application of PET -

Automotive - Structural parts such as luggage Racks and grills, Functional Housing such as windshild wiper motor Housing, fule filters.

Appliances - Oven and appliance Handle, Coil form for micro wave oven transfarmars, Pannels, Instruments Cover.

Electrical and Electronics - lamp socket, electronic Connecter and thrust washer.

Films - x-Ray, magnatic Tap, Printing sheets, photographic film.

Furniture - Chair arm, Sent Pans.

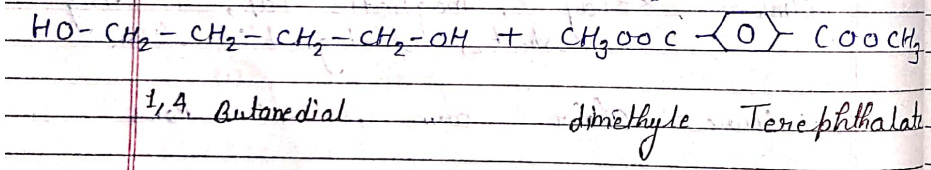
Packeging - Carbonated Soft drink Containers, distilled sprites, froat Products, Pical foods, Peenut butter, Spices, eatable oil and syrups.

miscellaneous - General Purpose pumps, Housing, mirror housing, 3D - Socket/s boards and structural Components in office automation equipments, Computers Housing, Containers, trays, blister and drinking Cups.

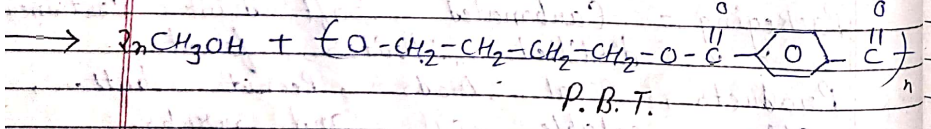
P.B.T.

Poly butylene terephthalate.

PBT also Called Poly tera methyl terephthalate PTMT Resin is a Sami Crystline Polyester Resin. It is produced by the Catalitic Poly Condunsation of 1,4 Butanedial and dimethyle Terephthalate.



1,4 Butanedial dimethyle Terephthalate



P.B.T.

Manufacturing of P.B.T. - It is manufactured by using similar Principals of PET manufacturing at first step. PBT is Produced by Catalitic Poly Condunsation of 1,4 Butanedial and Diemethyle Terephthalate.

Properties of PBT -

- PBT has a sharp melting Point 220°C
- PBT Resin has good electrical Insulation Property
- It HDT is 270°C
- Good Tensile strength.
- Excellent Dimantional stability.
- The smooth and hard Resin result of low Coefficient of friction.
- High hardness.

Processing of PBT - PBT Can be processed by the following Techniques.

Injection moulding
Extrusion moulding
Blow moulding.

★ "This Resin must be dried to a moisture of 0.02% or less before Processing. Condition the PBT at 120°C for 2-4 hours."

P.B.T. available in following greads-

- Glass Reinforced Gread.
- Impact modified Gread.
- Flame Retardent Gread.
- Mineral filled Grade
- Unmodified Grade.

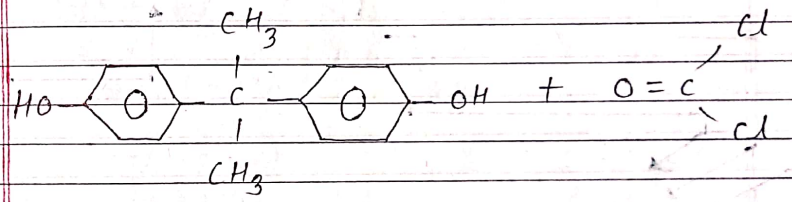
P.C.
Poly Carbonate

PC are Commercially produced by Inter Polymerization or melt Polymerization.

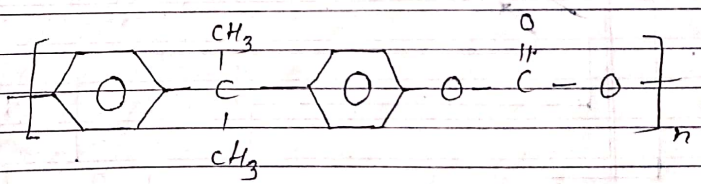
Interfacial Polymerization of Poly-Carbonates ~~invol~~ involve a reaction of BPA with Photogince at the interface between and an inert organic methylene Chloride solution and equis Caustic solution The reaction takes place two steps.

In first step phosgine react with BPA to form monochloro formates then the Poly carbo Condonsation takes Place between BPA hydronyl groups and

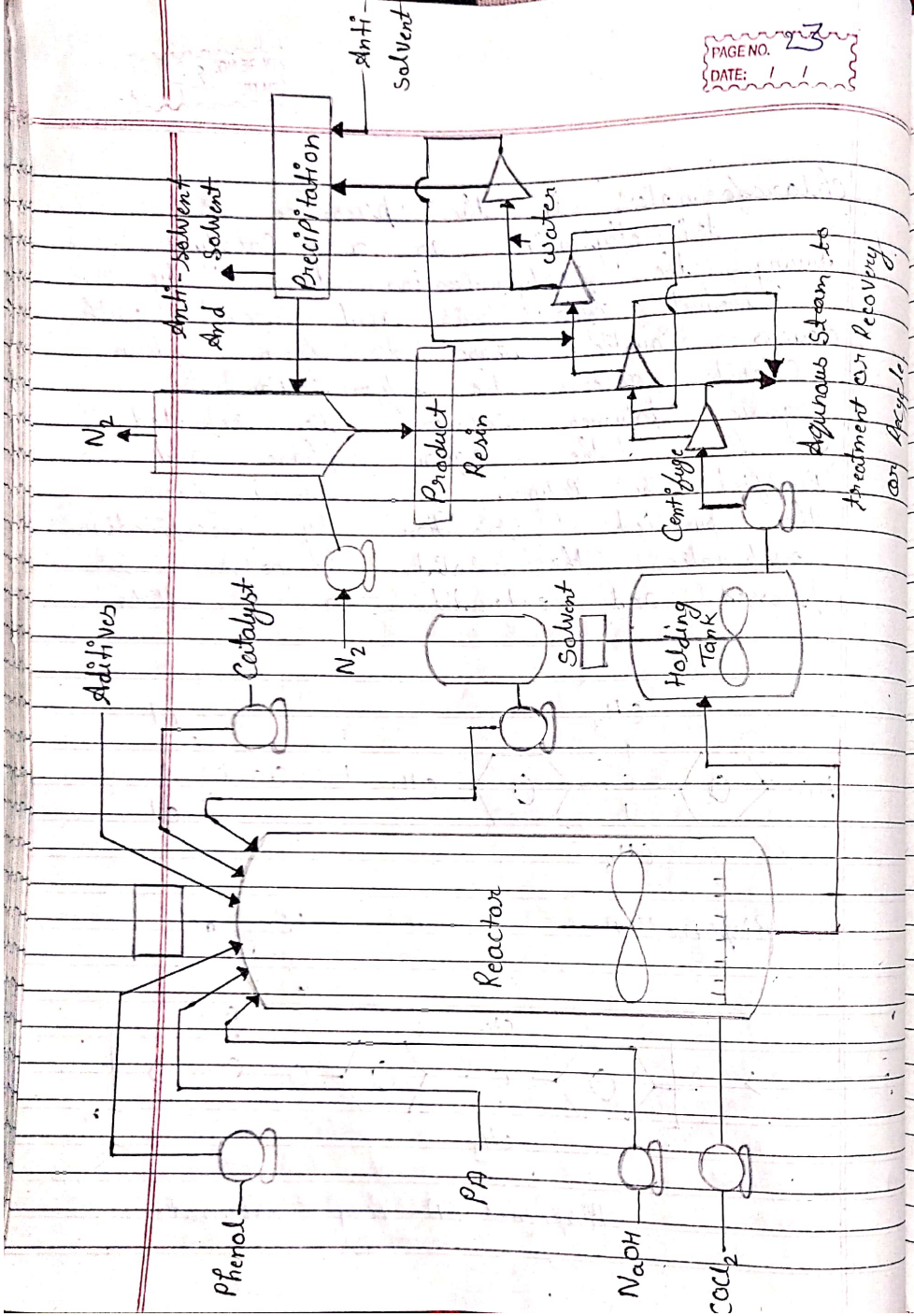
Chloroformates in the presence of tri-ethylamine as a Catalyst during the Polymerization the by product hydrochloric acid react with aqueous Caustic phase to form sodium Chloride after the polymerization the organic polymer solution is seprated from the aqueous phase and Purified The Polymer is record from the purified solution by precipitation evaporation the solid polymer is prossed and extrudid into pellets.



Bisphenol A Phosgene



Bisphenol A Poly Carbonate



Manufacturing - Poly carbonates are manufactured by condensation Polymerization of bisphenol A and phosgene.

Properties -

- High Impact strength.
- Light weight
- Protection from UV Radiations.
- Optical Nature.
- Good chemical Resistance.
- Good thermal properties.
- Good Toughness.
- Impact Resistance.
- Excellent mechanical Properties.

Processing -

- Injection moulding
- Extrusion
- Blow moulding
- Thermoforming.

Applications -

Appliances - Coffee filtters, Shower housing, Chocolate mould, Kitchen mixer bowls, housing for ball point Pen, Camera, Binoculars housing, housing for hair dryers.

Automotive - Car interior trims, Indicator lamps, door handles, tail lights, radiator grills, arial motors, fuse box, Bumpers, Chaises, levers.

Medical - Blood bottless, Surgical lighting

Optical - lenses for lighting, housing for steel lamps, window Pannels, traffic Signals, lamp holders, goggles. etc.

PVF

Poly vinyl Fluoride

$$[CH_2 - CHF]_n$$

PVF was Commercialized by "Du Pont." The monomer is manufactured by adding hydrogen Fluoride to acetylene.

$$CH \equiv CH + HF \longrightarrow CH_2 = CHF$$

$$n\,[CH_2 \equiv CHF] \longrightarrow \{CH_2 - CHF\}_n$$

M → The Crystalline melting Point is 198°C And molecular weight is 5×10^4 to 2×10^5.

- PVF Containing similar properties like PVC.

Properties -

- It's Density is 1.38 - 1.57
- It is non - Flameable material.
- The glass transition temp. is -20°C
- PVF films are transparent.

- Good chemical Resistance.
- High mechanical Properties like - Strength, stifness, Thoughness.
- Tough even at low temp.
- Good weather Resistance.

Applications -

- Roof Covering
- Cladding, Pipe Insulation
- Green House
- Solar Collectors
- Ply wood
- Insulating board
- Road signs.
- Packaging Films.
- Shrink Tube.

PTFE

Poly tetra fluoro ethylene [Taflon]

Preparation :→ Poly tetra fluoro ethylene are prepared by the addition polymerization of Tetra fluro ethylene in the presence of Benzoyl peroxide as a Catalyst.

Chemical Structure -

$$CF_2 = CF_2 \xrightarrow[\text{Peroxide.}]{\text{Benzoyl}} \left[CF_2 - CF_2 \right]_n$$

TFE PTFE

Properties -

High melting Point
Good Chemical Resistance.
Good electrical and di-electrical Properties.
Good weathering Resistance.
low Coficient of friction.
Good Hardness.
Insoluble in all Known Solvents.
High thermal stability.

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Processing Techniques. -

Ram extrusion.
Paste extrusion.
Coating
Compression moulding

Applications -

Packaging
Insulating film
Cable insulation.
maintenance free bearings.
glass fiber
O - rings and valve.
Seals and gaskets.
Teflon coated Cook ware
PTFE Taps.
Lab valve.
Teflon Bench : laminates.
Piston rings.

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PVDF / PVF_2

Poly vinyli dene fluoride.

Poly Vinylidene fluoride is generally synthesized by the free Radical Polymerization of 1,1 difluoro ethylene or Vinylidene fluoride.

Chemical Structure. -

$$CH_2 = CF_2 \longrightarrow +[CH_2 - CF_2]_n$$

Vinylidene fluoride — Poly Vinylidene fluoride.

Properties -

- High mechanical strength, stiffness and toughness.
- tough even at low temperature.
- Good chemical Resistance
- Excellent electrical Properties.
- PVDF melting Point is 171 °C
- Good weathering Resistance.
- Radiation Resistance.
- PVDF is non - toxic material.

Processing Tech. - • Injection Moulding
• Extrusion
• Coating.

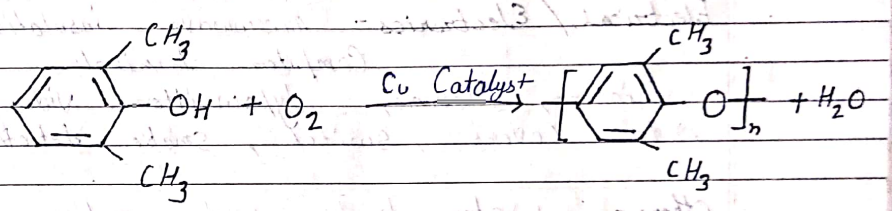
Applications :-
- Seals in Pump components.
- Transparent rigid Pipes.
- fitting, lyning for Pipe.
- Sensors.
- High Purity Semiconductors.
- Artificial membranes.
- Pipelines for Chemical.
- Nuclear waste processing.
- Battery.
- wire and cable coating, etc.

PPO

Poly - phenylene oxide

PPO is prepared from 2,6 dimethyl-phenol in the presence of Oxygen. The process is called Oxidative Cuppling reaction

Chemical Structure -



2,6 dimethyl phenol PPO

Properties -

- High melting Point
- Excellent electrical properties.
- Very good dimentional stability
- High Heat Distortion Temp
- low moulding Shrinkag.
- Good Impact Strength.
- flame retardancy.
- High Hardness, low water absorption.

Processing Tech. - • Extrusion
• Foam moulding
• Thermoforming

Applications -

Automotive - Outer mirror housing, Instrument Pannel, Steering Column, radiator tanks, Cable Connectors.

Electrical / Electronics - microwave insulation, Computer terminals, Printers, Modems, typewritter, Video game, motor Covers, switch, Smoke detectors.

Others - water pumps, water meters, Sprinkler system, hot water tank, washing machine parts, drink vending machines.

POM

Poly Oxy Methylene.

Introduction -

Poly oxy methylene (POM) is also Know as Poly acetal, Poly formaldehyde.

POM Resin manufactured by formeldehyde monomers.

Chemical Structure -

$$n\,(CH_2O) \longrightarrow \{CH_2 - O\}_n$$

formaldehyde P.O.M.

Properties -

- Excellent mechanical properties.
- Good dimentional Staibility
- Good Hardness.
- Good ~~too~~ toughness
- Good abrasion Resistance.
- Stiff and Rigide.
- Good electrical Properties but effected by moisture.
- Good Processiability.
- Good oil Resistance.
- Smooth surface

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Applications -

- **Appliances -** Gear, friction Pads, Rotors, Pully, nuts, Refrigrator Clips and brackets.

Automotive - Gas Cape, Pump Components, fule valve indicator, Bearings, mirror housing and Brackets.

Industrial - Springs, Valves, Bearings.

Consumer Products - Toys, Soft Dispenser, Combs, Pen and Pencils Barrels and tips.

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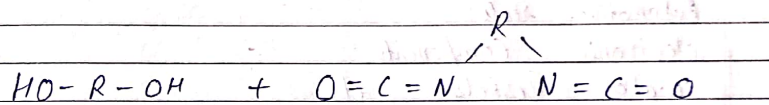
TPU

Thermoplastic Poly urethane

Thermoplastic Poly urethane is a type of thermoplastic elastomer known for its versatility and excellent physical properties.

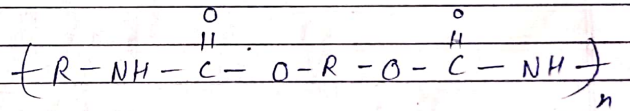
Poly Urethane is eighter a Thermoset or Thermoplastic Polymer.

Chemical Structure -



HO - R - OH + O = C = N - R - N = C = O

Polycol Isocyanate.



Properties -

- High Impact Strength.
- Abrasion Resistance
- UV stable
- High tensile strength.
- weather Resistance
- melting Point 240°C

UQT

Excellent electrical Properties
good Chemical Resistance
good Tear Resistance

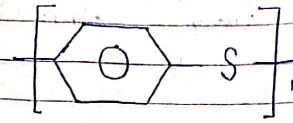
Applications -

Coveyor belts, Sports equipments, foot wear, adhesives, floor mats, mobile Phone Cover

flexible Plastics,
wheels.
Automative Parts
Automative seals
electronic Components
water Vessels. etc.

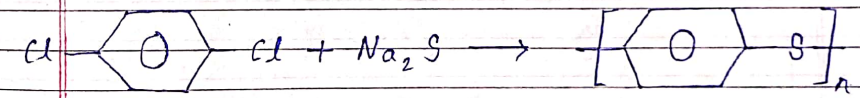
Unit - 2

Poly Phenylene Sulphide [PPS]



Manufacturing :- Poly Phenylene Sulphide Can be Prepared by 1,4 dichloro Benzen, Sodium Sulphide and a polar organic solvent

- PPS is available as a Crosslinked and Thermoplastic.
- PPS is an engineering thermoplastic.
- It is Composed by Alternating Benzen rings and sulfer atoms.



PPS

Properties -

- High Strength, stiffness, hardness
- Good Creep Resistance.
- Good Futique Resistance.
- High Heat Distortion temp.

- Good electrical Properties
- Good Chemical Resistance
- They have no Known solvent below 300°C.

Poly Sulfone [PS]

Introduction -

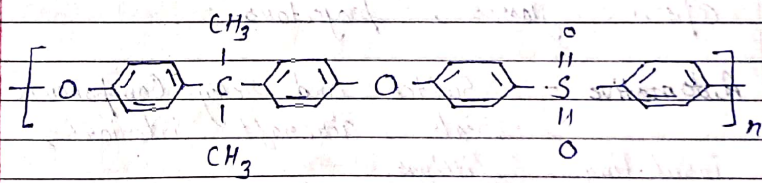
- Poly sulfone first introduced in 1965 by the union Carbide.
- Poly sulfone is an engineering thermoplastic.

They can be categorize in two groups.

- Poly Sulfone / Poly Aryl Sulfone
- Poly ether Sulfone / Poly Aryl ether sulfone

Manufacturing -

Poly sulfone is manufactured from Bisphenol A and 4,4 dichlorosulfonyl sulfone by a multi-step Condensation reaction.



Poly sulfone (PSu)

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Properties :→

- High Strength, stifness, hardness.
- High Thermal stability.
- High Processing Temperature.
- High Chemical Resistance.
- High flame resistance and low Smook Development.
- High electrical and di-electrical Properties.
- High Mechanical strength.

Applications :→

Medical - Medical tray, Containers, Surgical instruments.

electrical - Instrument cases, insulators, Connector track, Coil track, light fittings.

Consummer Products - food service Components, Coffe machines, Cameras, opera glasses, projectors.

Automotive - Switch and relay Components, seals, aircraft interiors, insulating fittings.

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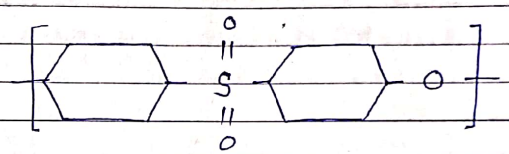
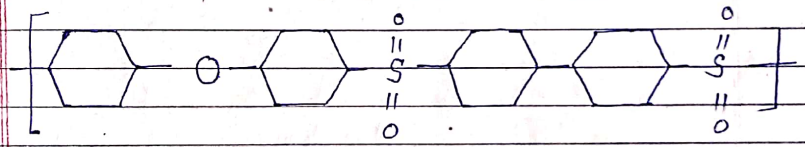
Poly ether sulfone [PES]
Poly aryl ether sulfone [PAES]

PES is a partialy aromatic Poly ether sulfone with methyl Containing linkage.

Manufacturing - PES is manufactured eighter either by poly Sulphonilation or by poly ether synthesis.





Properties :→

- High strength between -100 to +200°C
- High stifness and hardness.
- High Thermal stability.
- High Heat Resistance
- High Heat Distortion Temperature.
- Good wear Resistance.
- Good electrical and di-electrical Properties.

- Good resistance to stress Braking.
- Excellent Chemical Resistance.
- Good processibility.

⇒ The O=S=O group provide High Resistance to oxig oxidation degradation.

PEK

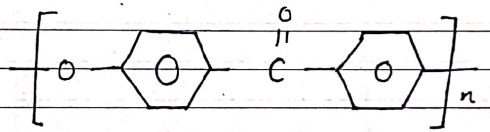
Poly Ether ketone

Introduction -

- Speciality plastic
- And used in engineering applications.
- It is Semi-Crystalline Thermoplastic material.

Manufacturing -

PEK obtain by the reaction of 4,4 difluoro benzophenone and 4,4 difluoroxy benzophenone in presence of Potassium Carbonate.

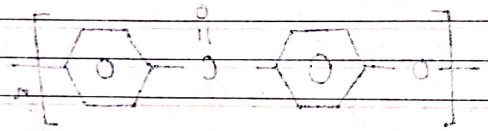


Properties -

High temperature Resistance
High wear Resistance.
Good chemical Resistance.
Good electrical Properties.
Good mechanical Properties
High Hardness, stiffness
Good thermal stability.

Applications -

Bearings, Gears.
Pumps
Compressor
Piston Parts
Cable insulation
Impellers
Handles.
Printed Circuit Board. etc.



PEEK

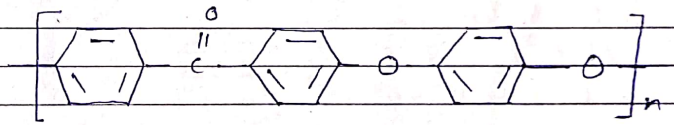
Poly ether ether ketone

- PEEK was first prepared in the UK Lab of ICI in 1977.

Manufacturing -

PEEK is manufactured by the Condensation of 4,4 - difluoro - benzophenone and disodium hydroquinone.

Chemical Structure -



Properties -

High Impact Strength.
High fatigue limit
High Heat Distortion temperature 315°C
High Chemical Resistance
easy processing
High Resistance to Radiation
Good electrical properties.

- Low flammability
- Very low gas and smoke Development.

Applications -

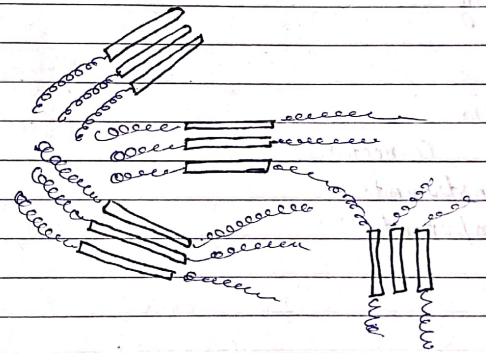
Sensor Coating
Gears.
Acid Delivery Pipes
Cable insulation
Pumps
Bearing
Piston Parts.
Automotive Industry
aircraft industry
electrical industry.

LCP
Liquid Crystal Polymers

Introduction -

- Liquid Crystal Polymer is also known as semi-reinforced Polymer
- LCP first introduced in 1965
- LCP is a middle state Polymer between liquid state and solid state.

Structure -



Properties -

- Medium density
- low coefficient of linear expansion.
- High Impact Resistance
- low moisture absorption
- low shrinkage.

- good electrical Properties.
- High tensile strength
- High Chemical Resistance.

Processing Tech -

- Injection moulding
- Extrusion
- Blow moulding

Applications -

- optical lens
- sockets.
- Coil Cores.
- LED Housing
- Switches
- Sensors.
- fuel system
- electronic Connectors.
- measuring instruments.
- Pump Components.
- Aircraft Cabins
- Cuplings
- buffer films

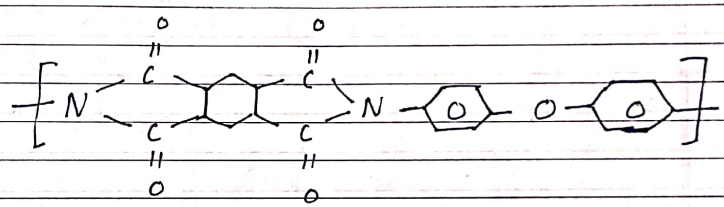
PI

Poly Imide

- Speciality Plastic
- Poly imide manufactured by Poly Condensation or Poly adition.

Manufacturing -

Poly Imide manufactured by the reaction of Di-anhydride and Diamine and we optian P.I

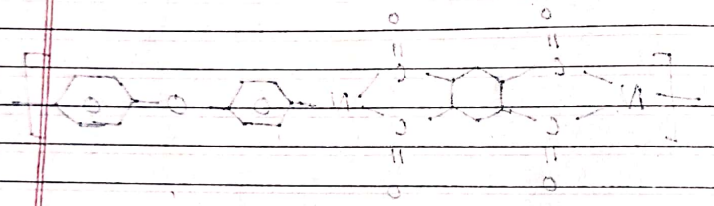


Properties -

- Good electrical Property
- flame resistance
- Good chemical resistance
- High strength, stiffness, hardness
- easily avilable

Application –

- Valves
- Seals
- engine Parts
- Printed Circite boards
- grips
- Automobile accessories

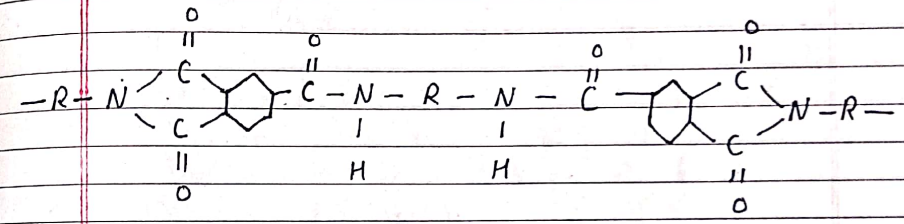


PAI

Poly Amide Imide

Poly Amide Imide manufactured by the reaction of teremellitic anhydrade with aromatic diamine

Chemical structure –



Poly amide imide

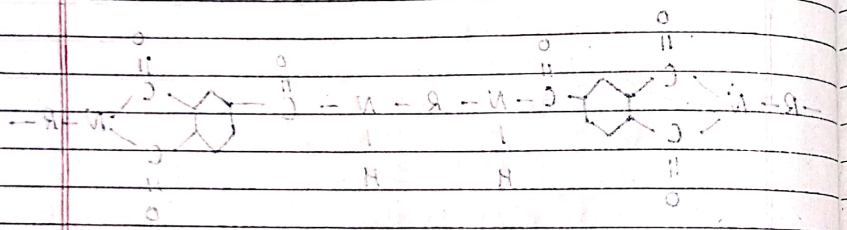
Properties –

Excellent mechanical Properties
Good Hardness, stiffness
Good Impact Resistance
flame Retardrent
UV Stability
Excellent dimentional staibility
High HDT 265°C
High strength between
good Chemical Resistance.

Good weathering Resistance
Good electrical Properties.

Application -

Gears
Bearing
Compressor vanes.
pump impeller
Semi Conductor test socket.



Unit-3

Polymer Blends and Alloys.

Polymer Blend - A Polymer Blend is a mixture of two or more Polymers That have been blended together to Creat a new material with different Physical properties.

Generaly there are five types of Polymer blend.

1) Thermoplastic Blend
2) Thermoplastic - Rubber Blend.
3) Thermoplastic - Thermosetting Blend
4) Rubber - Thermosetting Blend.
5) Polymer filler Blends.

Importance of Polymer Blends.

- Reduse material cost
- Light weight
- Extended service temperature
- Inhanced Ozone Resistance.
- Improve Hardness
- Increased Toughning
- flame Resistance.
- Improve Impact strength.

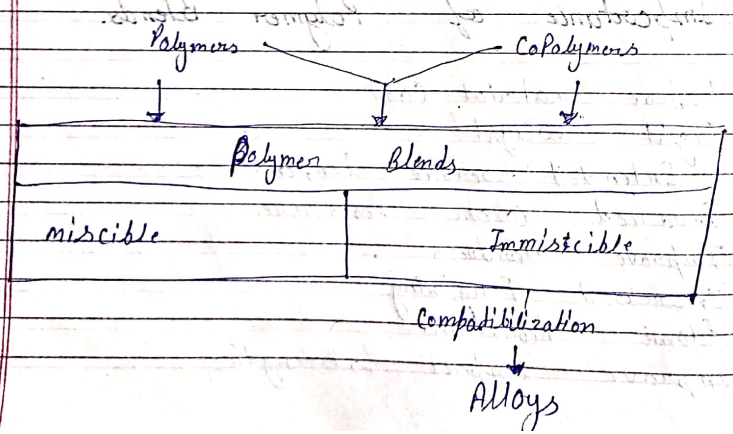
Polymer Blend

- Immiscible
  - Blend have more then one T_g
- Miscible
  - Blends have only One T_g.

where T_g = Glass Transition Temp.

Polymer alloys -

Polymer alloys is also a same type of Polymer Blends but the difference is Blend mixture are not fully Compatible but Alloy mixtures are fully Compatible.



Unit-4

Bio-degradable Plastic and Bio Plastics.

Bio-degradable Plastic -

Bio degradable Plastics are those that Can decompose naturally in the ~~envio~~ envriament.

Bio-degradable Plastic is plastic that's designed to break up when exposed to the presence of microorganisms.

Examples -
PBAT, PBS, PCL, Cellulose etc.

- Biodegadable Plastics are Petroleum based Plastic.
- Biodegadable Plastics made by Petrochemicals and Combination of additives.
- Biodegradable plastic is also harmful for nature.

Bio-Plastic -

Bio-Plastics are Plastic materials produced from renewable biomass sources such as vegetable fats and oil, corn starch, straw, wood chips etc.

Some bio-plastics are obtained by processing directly from natural bio polymer including.

Examples -

- Starch
- PLA
- Bio derived Polyethylene
- Cellulose

Advantages of Biodegradable Plastic -

Carbon emission Reduction
Consumes less energy
less Landfill are needed

Dis-advantages of Biodegradable Plastic -

- Not all Biodegradable Plastics are Created equaly.
- Biodegradable Plastics are expansive
- Release Harmful Substance during Braking Down
- For Degradation Require as specific pressure and atmospheyes Conditions.