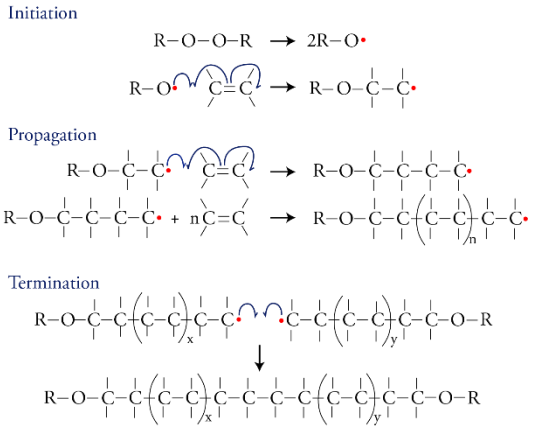
Addition Polymers

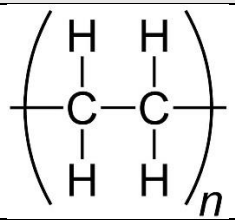
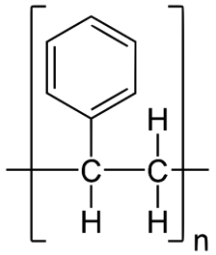
Addition polymerisation is the addition of monomers to a polymer chain through double (or triple) bonds of the monomers.

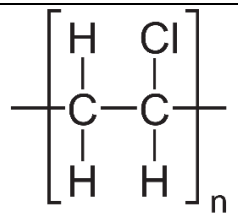
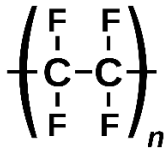
Steps

1. Initiation – an initiator (such as peroxide) containing a free valence electron will bond to one side of a monomer, forming a free radical. The free valence electron "spot" will move to the end of the chain.
2. Propagation – Monomers continue to add to the end of the chain. A long enough chain may bend back on itself, resulting in the radical moving into the middle of the chain and creating a branch. This is called backbiting.
3. Termination – when two polymers meet and join at the radical, the polymer is complete.



Examples

Polymer	Common name	Abbreviation	Structure	Monomer	Process	Comments
Low density polyethylene		LDPE		Ethene		Has high branching
High density polyethylene		HDPE			Polymerisation occurs on surface of catalysts (e.g. Ziegler catalysts)	Has low branching
Crystal Polystyrene		PS, Crystal		Styrene (ethene is combined with benzene with aluminium catalyst and high temperatures, then sulfur catalysed dehydrogenation makes styrene)		Large benzene rings make for high stiffness
Expanded polystyrene	Styrofoam	EPS			Made by blasting melted crystal PS with compressed air	

Polyvinylchloride	PVC .	PVC		Chloroethene (vinyl chloride)		Has dipole-dipole bonds between chains (due to Cl), so is stronger than PE (which has dispersion only)
Polytetrafluoroethylene	Teflon	PTFE		Tetrafluoroethylene	TFE is made from CaF_2, H_2SO_4, and $CHCl_3$. The polymerisation is complex	Repels all substances, heat resistant, strong, acid/base/solvent resistant, slippery

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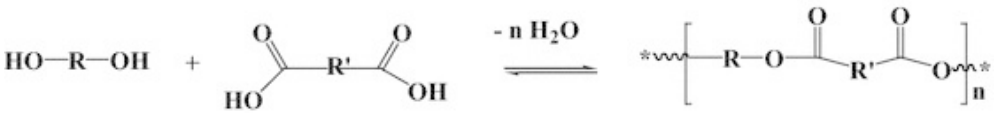
Condensation Polymers

Condensation Polymerisation is the combination of chemicals resulting in a by-product such as water of methanol

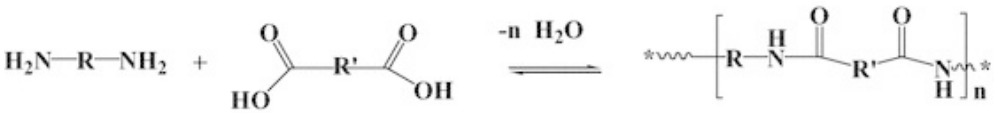
Steps

1. Two monomers with the same functional group on both ends joins at one of their functional groups, producing a by-product such as water. This is called a dimer.
2. Dimers join together to form a polymer, producing a by-product at each step.

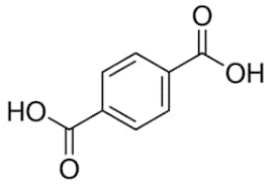
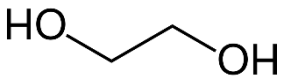
Polyester



Polyamide



Examples

Name	Common name	Parent monomers	By product	Common example
Polyester		Dicarboxylic acid and diol	Water	PET (textiles, electronics, water bottles, etc.) – Polyethylene tetraphalate. Made from Ethylene glycol and terephthalic acid  
Polyamide	Nylon	Dicarboxylic acid and diamine		Nylon 66 (airbags, tyres, ropes, hoses). Made from hexamethylenediamine and adipic acid