Polymerization

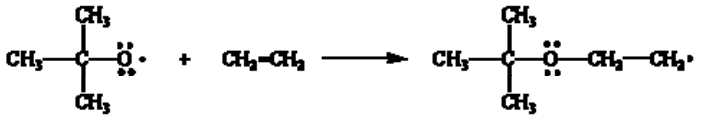
What is Polymerization?

- A process of reacting monomer molecules together in a chemical reaction to form three-dimensional networks or polymer chains

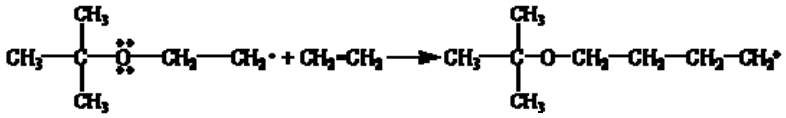
Addition Polymerization

- Addition polymerization usually requires the presence of a small amount of initiator
- Among the most common of these initiators are the peroxides
  - The function of the peroxide is to produce a free radical (an atom or group of atoms possessing an unpaired electron, $CH_3\bullet$)
  - The free radical produced by the peroxide is R-O●

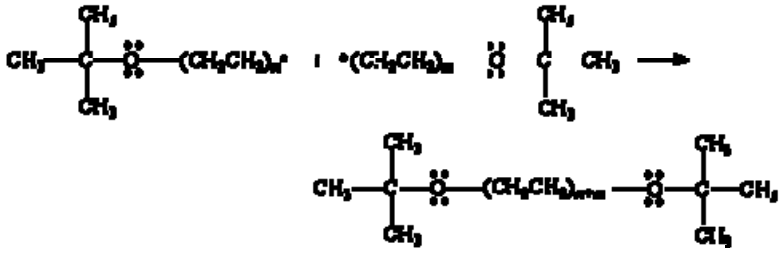
- These very reactive free radicals add to alkenes to form new larger free radicals



- The process can continue with more monomers adding on to the chain



- Eventually the process terminates when two free radicals join together



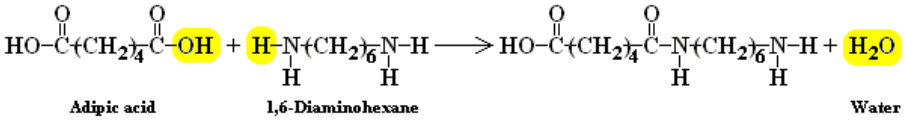
  - Even the smallest impurity in the reaction vessel will initiate chain termination so the monomers that are used are among the purest organic compounds produced

Some Addition Polymers

- Polyethylene
  - Film wrap, plastic bags, bottles, toys
- Polystyrene
  - Toys, cabinets, foam packaging
- Polytetrafluoroethylene (Teflon®)
  - Non-stick surfaces
- Polychloroprene (neoprene)
  - Synthetic rubber

Condensation Polymers

- The polymer is formed from a reaction that releases small molecules as by-products such as water, methanol, ammonia, or hydrogen chloride
- The monomers in this case are saturated



Some Condensation Polymers

- Nylon
- Dacron®
  - Synthetic polyester fiber
- Mylar®
  - Synthetic film

The Bottom Line

- Condensation polymerizations give off byproducts
- Addition polymerizations don't give off byproducts

Cross-Linked Polymers

- Cross-linked polymers are formed by linking together long chains into gigantic three dimensional structures with great rigidity
- Both addition and condensation polymers can exist with cross-linking

Some Cross-Linked Polymers

- Phenol formaldehyde resin (Bakelite™)
- Rubber
- Fiberglass resin