- ✖ preventing the polymer chains from packing together closely
- ✖ expecting to be softer and more flexible, when actually atactic PVC is quite rigid due to the chlorine atoms being more electronegative than the carbon atoms and so it obtains a partial negative charge (δ^-) whilst the carbon has a partial positive charge (δ^+). This results in a dipole-dipole interaction = strength and rigidity.

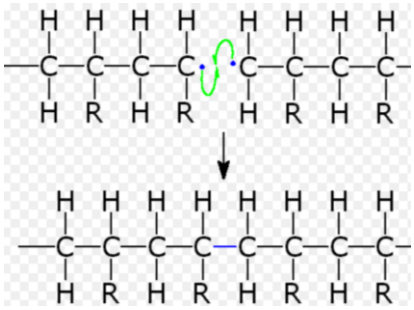
4. Termination

The reaction terminates when

(a) two free radicals react with each other and cancel each other out

(b) reaction with an impurity

(c) induced termination by quenching



Property	Polyvinyl chloride (PVC)	Uses
Melting Point	160°C	Joining PVC sewage pipes by heat-fusion results in joints that don't leak.
Crystallinity	Irregular packing and low crystallinity (amorphous) as atactic polymer chains	Rigid PVC is used for drainpipes, gutters and can be moulded to produce wood grain effects used in housing materials (window and door frames, and PVC siding)
Flexibility	rigid	Plasticizers added to improve flexibility. Flexible PVC can be used to make clothes, footwear, hoses even credit cards.
Electrical conductivity	poor: PVC is a good insulator	Used as an insulating material for low-medium voltage applications.
Heat Resistance	poor: degradation by loss of HCl begins at 70°C	Heat stabilizers added to improve heat stability. Heat stabilized PVC can be used for hot water pipes.
Transparency	white opaque solid	
Density	≈ 1.3 g cm^{-3}	
Chemical Properties	Resistant to acid, alkali and most inorganic chemicals. Dissolves in aromatic hydrocarbons, ketones and cyclic ethers.	PVC is suitable for use in food containers, bottles, tubes, hoses and exhaust gas ducts. Printing on, and adhesion to, PVC is enhanced by the C-Cl polar groups making it suitable for signage.

b. Large e.g. sodium polystyrenesulfonate: Affect conductivity and structural properties too. Also, affects material properties more dramatically and can increase density. Large dopants are more integrated into the polymer and won't leach out over time or with electrical stimulus = polymer has greater electrochemical stability ☺

P-DOPING:

- A popular dopant is iodine (I_2) which removes electrons to form I_3^-, but other halogens are commonly used due to their ability to easily remove or add electrons. The process…

Iodine molecule I_2 → I_3^-

An electron is attracted by the iodine molecule, leaving behind a positively charged polyacetylene molecule which is called a "Polaron" or "Radical Cation"

- A gap has been created within the polymer backbone which allows the lonely electron, now dissociated from the double bond, to move. This results in the double bond successively moving along the polymer backbone and a charge begins to flow. The positive charge is fixed by electrostatic attraction to the iodide ion and is unable to move so readily.

N-DOPING:

- Achieved by partial reduction of the pi-system backbone – dopant adds electron to the system. N-doping can be carried out chemically using sodium naphthalide or n-butyl lithium in hexane.

Advantages of doping:

- ✓ Most polymers in natural state are either insulators or semi-conductors… When subject to doping, the conductivity values are comparable to metals such as silver and copper!

These conducting polymers are also

- ✓ More accessible
- ✓ Light weight
- ✓ Better resistance to pH and temperature, therefore, unlikely to undergo degradation
- ✓ Good biocompatibility
- ✓ Ability to form networks and carrier molecules

(YouTube link on slide 28)