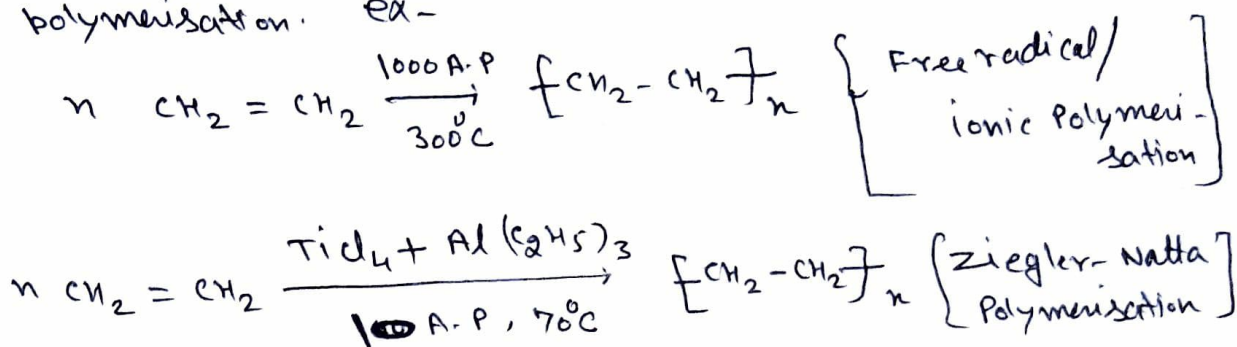


# Ziegler-Natta Polymerization

1. Vinyl monomers can be polymerized by using Ziegler-Natta catalyst  $[TiCl_4 + (C_2H_5)_3Al]$ . This polymerization is also known as Coordination polymerization.

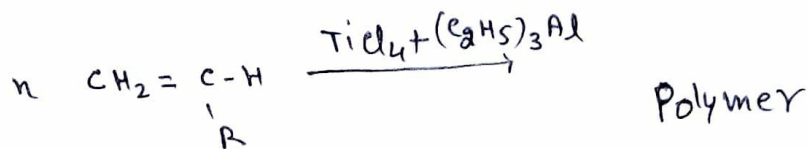
2. The polymers obtained from ionic/free radical mechanism has less density while the polymer obtained by Ziegler-Natta Polymerization has high density.

3. Ziegler-Natta Polymerisation require low temperature and low pressure in comparison of free radical/ionic polymerisation. ex-

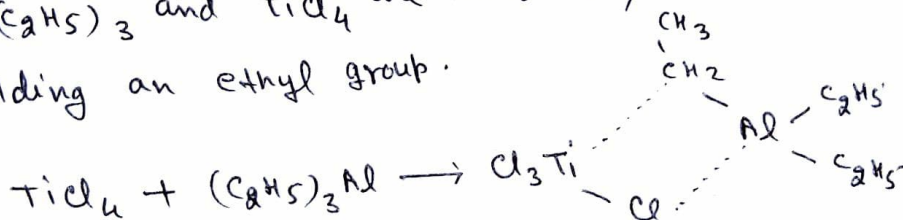


4. Polymers obtained from free radical/ionic mechanism have a highly branched while by using Ziegler-Natta polymerisation, linear polymers are obtained.

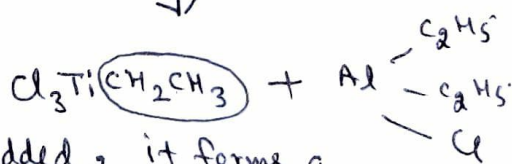
## Mechanism -



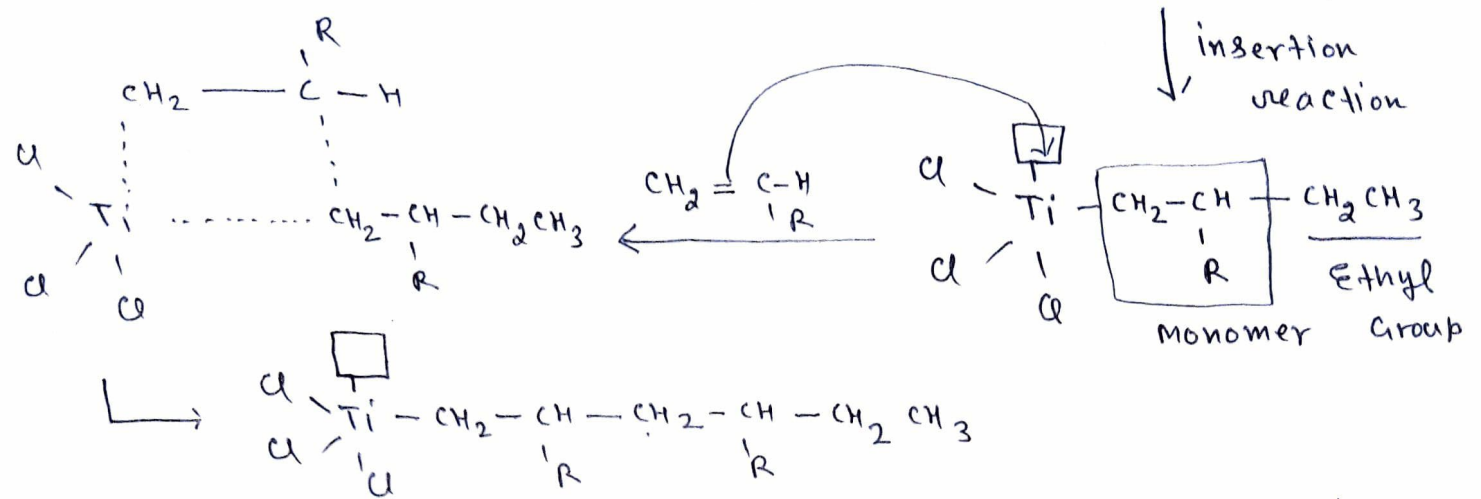
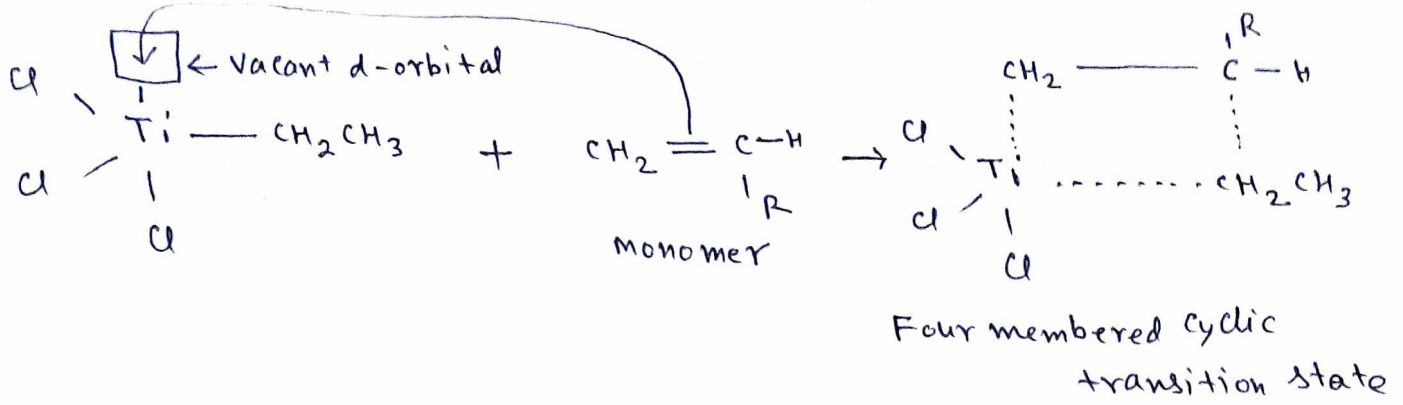
①  $Al(C_2H_5)_3$  and  $TiCl_4$  are mixed they form a titanium complex holding an ethyl group.



↓



② When an alkene (monomer) is added, it forms a coordination complex with Titanium by donating its  $\pi$ -electron i.e.  $\pi$ -electron cloud of ene overlap with an empty d-orbital of Ti. Due to this coordination, the bond b/w Ti and  $C_2H_5$  group is weakened.



3. Due to insertion reaction, monomer is inserted between the Ti and Ethyl group.
4. The binding site where the monomer was held earlier is now vacant and another monomer gets  $\pi$ -bonded to the metal and then inserts between the Ti and the n-butyl group (in case of ethylene monomer) to form n-hexyl group. So, the process continues over and over.
5. Ultimately, insertion of H occurs either by  $\beta$ -elimination or by hydrogenation and the molecule of polymer gets separated from the metal.

