Other performance fibres

Module 5: FAQ

Q1. Define Elastomeric Materials.

Ans*:* 'An elastomeric material is one which at room temperature can be stretched repeatedly to at least twice its original length and upon immediate release of stretch, will return with force to its approximate original length.'

Q2. Explain the chemistry of polymerization of elastomeric polyurethanes.

Ans: It involves two steps :

a) Prepolymer formation: In the polymerization process, a high molecular weight diol (polyol) is reacted with two moles of diisocyanate to form a prepolymer having isocyanate groups on both ends. The function of the diisocyanate is to convert the two hydroxyl end groups in polyol to diisocyanate ends. But inevitably some diisocyanates link glycols and therefore dimers, trimers etc. are formed. This chain growth can be increased by dropping the diisocyanate ratio below 2. The capped polyol or macrodiisocyanate is oligomeric with a characteristic molecular weight distribution. It contains unreacted diisocyanate, because for every diisocyanate that links two glycols, another is left unreacted. The high molecular weight diol or polyol can be either ether based or ester based depending upon the type of linking groups. Polyoxytetramethylene glycol (PTMG) is an example of ether based polyol, while polyadipate and polycaprolactone are ester based polyols. Diphenyl methane 4,4'-diisocyanate(MDI) or toluene-2,4-diisocyanate(TDI) is used as capping agent.

b) Chain extension: This prepolymer is then reacted with a chain extender i.e. a diamine or a diol to form a high molecular weight polyurethane. On reaction with isocyanate group, the diamine chain extender molecule will form polyurea rigid segments and diol chain extender molecule will form polyurethane rigid segments. This fundamental difference between the diol and diamine extended materials leads to differences in physical properties between the two classes.

Q3. How is the melt spinning of PU different from general melt spinning process?

Ans:

- In case of PU melt spinning tacky fibres are made and they have strong tendency to fuse together so spinning of multifilament is tricky.
- The milder intermolecular attractive forces in polyurethane segments result in reducing the final spinning temperature

Q4. How is the production of lyocell different from viscose fibre production.

Ans: In case of viscose or regenerated cellulose fibre, derivatization of cellulose in CS_2 or in cupraammonium followed by subsequent spinning and coagulation was done while in lyocell, cellulose is dissolved in solvent without derivatization, the problems associated with derivatization and regeneration can be avoided, resulting in reduced environmental pollution and chemical waste generation

Q5. What is the solvent used for spinning lyocell fibre?

Ans: NMMO/water

Q6. How is the dissolution of cellulose achieved?

Ans: At lower concentrations of water, oxygen of N-O can form hydrogen bonds with cellulose hydroxyl groups and the dissolution can occur.