General Introduction and development of high performance fibres

Module 1: FAQ

Q1. What are high performance fibres?

Ans: Fibres having remarkably high:

Tensile strength and modulus

Resistance to heat, flame

Resistance to chemical agents that normally degrade conventional fibres.

Q2. Define speciality fibres.

Ans: Fibres made from commonly available raw materials or new materials and have special performance properties such as

- Dyeability
- Adhesion
- Absorbency
- Conductivity
- Flame retardancy
- Response to external stimuli (produced from specialty polymers),
- Special surface characteristics (produced by special techniques)etc.

Q3. How are high performance or specialty fibres different from commodity fibres?

Ans: The following table shows the main differences between the two

Classes

Conventional fibres	High performance and Speciality fibres
Volume Driven	Technically Driven
Price Oriented	Application Oriented
Large Scale Production	Smaller Batch Production

Q4. What structural characteristics in a polymer make it a high performance fibre forming material with outstanding mechanical properties?

Ans: Intrinsically rigid interactive polymer chain structure and highly flexible and inert polymer chains

Q5. Justify the reasons given in above question.(Q 4)

Ans: These are valid because,

- Rigid highly interactive chains tend to associate as blocks of parallel chains or liquid crystals. The polymer molecules are naturally fully extended because the folding is difficult owing to rigidity of their structure. The stretching of such a system during solidification would result in a highly oriented structure
- It is easy to pull out flexible , inert chain-molecules into a fully-extended, oriented state

Q6. Why are high performance and speciality fibres required?

Ans: For special technical functions like flame-retardancy, hydrophilicity, hydrophobicity, biocompatibility, smart and responsive textiles, sensors that require specific physical properties which are unique to these fibres

Q7. Give two approaches to make speciality fibres.

Ans: Speciality fibres can be made by:

Using Additives such as colorants, flame retardants, conducting fillers, antistatic compounds, etc. during the spinning process.

Surface Modification: Fibre finishes can be engineered for specific fibre properties, such as hydrophilicity, high absorbency, low friction, etc. or modification by plasma.

Q8. Give examples of two high performance fibres and two specialty fibres.

Ans: High Performance Fibres: Kevlar, Nomex, Speciality Fibres: Soft-switch (stimuli sensitive fibres), nanofibres

Q9. State whether the following statements are TRUE or FALSE

a) Based upon the nature of bonding High performance fibres these can be classified as: linear, two dimensional and three dimensional (True)
b) The examples of first generation fibres are: nylon and polyester, aramids, stimuli responsive polymers (False)
c) Third generation fibres are also called : stimuli responsive or smart fibres (True)
d) 3-d fibres have mechanical properties comparable to high performance (False)