

NAME

ENTRY No

DEPARTMENT OF TEXTILE TECHNOLOGY
TTL311: High Performance and Specialty Fibres
Minor Test II

Oct. 7th, 2013
Total Marks 20

Answer all the questions in the space provided.

Q1A. Explain, how the fibre production process for carbon fibre PAN precursor is different from the textile grade acrylic fibre production process? (4 marks)

In fibre production for carbon fibre PAN precursor forming polymers are called SAF (Special Acrylic Fibres) polymers. These polymers have high molecular weight with linear molecules having no defect. They have polydispersity of 2-3. The precursor fibres have high orientation with no foreign impurity. The nature of comonomers is taken into account. The diameter of the precursor fibres are 1-2 denier, molecular mass number of filaments, jet flow are used. The comonomers are used in a such a way that this reduces cyclization temperature and amount of heat release during the exothermic cyclization processes.

1B. EXPLAIN the importance of stabilization step in carbon fibre production using PAN precursor. For production of good quality carbon fibres, what are the two key controlling parameters (during the stabilization of PAN precursor)? Explain their roles. (2+1+1 marks)

The importance of stabilization process is that the precursor fibres undergo this process and prepared for stabilization against high temperature condition.

1C. How is the carbon fibre production process based on Pitch precursors fundamentally different from the other processes used for producing high performance fibres? (1 mark)

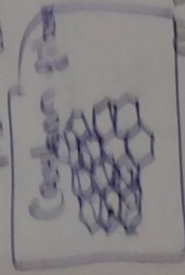
Carbon fibre production based on pitch precursors is fundamentally different from other fibres because pitch precursors are made from substitution distribution of distributions so it does consist of carbon so we need less carbonization is required. It already consists of high carbon content, only requires more carbonization time sheets. whereas other fibres start from a precursor having separates like hydrogen, oxygen, nitrogen etc.

1D. What is the main difference in the structure of carbon fibre and aramid fibres? (1 mark)

The carbon is made up of (crystalline)

graphite 92% (carbon and present in random layer structures. The sheets

of carbon are ~~in~~ in random direction whereas ~~in~~ in amide sheets are joined together by (conformational) polymer chains. No sheet like structure is present.



1E. What is the mechanism of dissolution of cellulose in NMMO? How is this understanding used in dope preparation process in Lyocell fibre production?

Pure NMMO has high melting point of 170°C and after 150°C the solvent becomes very corrosive and highly exothermic. So NMMO monohydrate and dihydrate, 35 and 34°C (MP). So we use NMMO monohydrate solution. Basically we make a slurry of 50-60% aqueous NMMO and pulp (cellulose) in this 20-30% in 2 water 10-15% in cellulose and rest is NMMO.