

Polymer blends and composites

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1. Explain briefly

- i) Fibre architecture.
- ii) Importance of stress transfer in polymer composites
- iii) Name two examples of polymer composites and one application of each.

2. Cox shear-lag model.

- i) Shear-lag model, explain the significance of aspect ratio on the mechanical properties, using a diagram.
- ii) In a hemp short fibre composite, where all fibres are oriented axially, where is the interfacial de-bonding going to occur and why, if the matrix and reinforcement remain unyielding and the stress is parallel to the axis of the unidirectional fibres?

3. What is compatibilization of polymer blends and composites, and why is it used. Name two examples of compatibilized polymer blends or composites

4. Stiffness.

- i) Unidirectional long-fibre composites loaded axially and transversely can be modelled using the equal strain (Voigt) and equal stress (Reuss) models. Explain how the axial modulus, E_1 , and transverse modulus, E_2 , can be calculated with the terms V_f , E_f , V_m and V_m .
- ii) Calculate the theoretical axial and transverse Young's moduli for a unidirectional composite with a V_f of 0.65. The fibre fractions Young's modulus is 76 GPa and the matrix's is 1 Gpa.

5. Toughness.

- i) Why is interfacial bonding important for toughness in composites using brittle materials like fibreglass or polyester?
- ii) Name the main mechanisms for energy absorption that contribute to the work of fracture in composites.