

PTL 706 : Polymer Testing and Properties

Major Test, Sem. II, 2006-07

F.M. : 53

Time : 2 H

1. A composite of carbon fiber-polyimide resin was made in the form of a beam 30 cm long, 2.4 cm in thickness, and 2.8 cm in width. In a three-point bending test a load of 6 kg was applied in the midspan. Calculate the deflection, flexural strain, and flexural strength of the beam. The Young's modulus was $5.8 \times 10^9 \text{ N/m}^2$.
(10)

2. Tensile tests were performed on a polymer where the following load-deformation data were obtained. Calculate and plot the stress-strain curve. The specimens were 5 cm long, with width of 1.3 cm and thickness of 3.2 mm. What is the Young's modulus? Also estimate the ultimate tensile strength and the strain-at-break.

Load(kg)	Change in length (cm)
56.3	0.025
113.5	0.050
160	0.076
174.7	0.097 (fracture)

(10)

- 3 (a) Silver-coated glass fibers were incorporated into polypropylene. The composite was injection molded in the form of a disc 2.32 cm x 2.32 cm in the sides and 1.2 cm in the thickness. The sample was tested for thermal conductivity. The temperatures on the opposing surfaces across the thickness were 90°C and 40°C , respectively. The heat flow measured was 21.8 W. Estimate the thermal conductivity of the sample.

- (b) Write a brief description on abrasion resistant applications of elastomers in bearings and seals.

(6 + 4 = 10)

4. (a) Charpy mode of impact strength measurements were employed on plastic samples. The samples were rectangular bars of length 4.2 cm, breadth 0.8 cm, and width 3.4 mm. The fracture energies were 0.40 kg.m, 0.55 kg.m, and 0.93 kg.m, for notch depths of 1.81 mm, 1.59 mm, and 1.43 mm, respectively. Calculate the impact strength of the samples. Also comment on the impact behavior of the material.
- (b) Describe the effects of the following parameters on the stress-cracking behavior of polyethylene:

- i) molecular weight distribution
- ii) stress

(4+1)+(2+3)=10

5. (a) Give a brief account on the impact properties of glass-fiber reinforced thermoset plastics.
(b) In the hardness measurements of polymers why the time interval of the force application must be specified?
(c) Select suitable hardness for the following products. Justify your selection.
i) Hawian chappal sole
ii) Eraser for children

$$4+1+(1+1)=7$$

6. Select relevant tests for the following polymer products as well as the base polymer for the products. Give reasons for the selection of the tests.
i) gymnasium window
ii) a gear for a business machine
iii) flower pot

$$(3 \times 2 = 6)$$