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Interface and dynamic indentation of crosslinked polyester films

SURESH AHUJA, Xerox Corporation — The nanoindentation technique has drawn much interest recently for both its efficiency and versatility in measuring the mechanical properties of small volumes of materials and thin films. Since the unloading curve of polymers depends not only on the holding time but also on the unloading rate Hysitron Nanoindenter was used in our investigation of contact deformation of surfaces of polyester and polycarbonate supported on an aluminum substrate. Crosslinked polyesters with different gel concentration were produced on aluminum surfaces. Inter-phase plays a crucial role in composites. Stiffening and strengthening rely on load transfer across the interface, toughness is influenced by crack deflection/fiber pull-out, and ductility is affected by relaxation of peak stresses near the interface. Instead of strain softening with indentation depth observed in linear polymers, cross-linked polymers showed strain hardening. The extent of diffusion determines the extent of the interfacial region with the conformation loss of large molecules being higher than that of small molecules. Besides, considering the strain-hardening.an increasing stress is required to produce further plastic deformation after the material is strained beyond the yielding point, it is possible to separate the plastic deformation and the visco-elastic deformation and study them individually. Steady state deformation is compared with sinusoidal deformation relatable to differences in Tg from confinement effects. In cross-linked polymers, surface deformation is analyzed a three-layer model consisting of free surface layer, intermediate layer, and interface layer. Molecular relaxation dependence on molecular weight and cross-link density is shown.

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