

Investigation of Recovery Phenomenon at Room Temperature of a Glassy SU-8 Thermoset

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SU-8 is a glassy epoxy thermoset polymer which is extensively used for fabricating micro-electrical mechanical system (MEMS) components. SU-8 undergoes elastic and viscoelastic recovery during unloading, followed by viscoelastic recovery after complete unloading (zero-load recovery). The investigation of these recovery phenomenon is carried out for ~ 82 % (post-exposure baked) and ~ 95 % (hard baked) cross-linked SU-8 samples via nanoindentation with Berkovich tip. SPM imaging was used to observe zero-load recovery at various points along the edges and the facets of the residual imprints. These images are analyzed by relating the deformation and deformation rate distribution with respect to the geometry of the indenter. This enables relating the recovery to deformation extent and deformation rate. The fractional zero-load recovery is expectedly higher for the more cross-linked samples and decays exponentially with greater retardation time. Mapping the nanoindentation recovery to the micro-compression data from the literature, enables the relating of the uniaxial strain rate to the effective indentation strain rate. The relationship is consistent with the deformation geometry and mechanics.

Keywords: SU-8; Recovery; Nanoindentation, SPM imaging, Deformation geometry