

Deformation and Fracture of Dual Cross-link Hydrogels

Alan Zehnder

Hydrogels are soft materials with moduli in the kPa range and can sustain very large deformation prior to fracture. We study the constitutive and fracture behavior of a dual cross-link PVA gel. We have developed a three-dimensional constitutive model that can fit a wide range of experimental data for the PVA gel including tensile loading/unloading, stress relaxation and torsional rheometry from 13 to 50 deg. C. Fracture tests were performed under constant strain rate loading and under constant stress (creep rupture fracture). Using our constitutive model, the crack tip fields have been studied. These results were used to analyze the creep rupture experiments and to develop a kinetic theory of fracture was used to correlate the creep rupture data and fracture under constant stretch rate loading.