The strain sensing of carbon nanotube-reinforced adhesive using viscoelasticity

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Due to their excellent electrical and mechanical properties, carbon nanotubes (CNT) have been intensively investigated for many structural and electronic applications. Many studies have shown that CNT can be used as a reinforcing agent for polymers. CNT-reinforced polymers are also known to exhibit electrical conductivity and strain-dependent resistance. In this study, CNT- reinforced adhesives were manufactured and their electrical and mechanical properties were studied. Strain sensing ability of the composite adhesive was tested by measuring the resistance change during lap shear test. The dependence of the mechanical and electrical properties of the composite adhesives on the aspect ratio and concentration of CNT was also studied. For mechanical properties, the stress-strain behavior varies with strain rate, so the viscoelastic properties of the composite adhesive were measured because it can represent the behavior of the polymer with strain rate. Stress relaxation tests were also performed at various strains to obtain parameters for the nonlinear viscoelastic model. The electrical resistivity history of the adhesive allowed us to calculate how the deformation changed in the adhesive. Using a viscoelastic model and this strain history, numerical simulation of the adhesive was also performed to investigate how the stress was applied to the adhesive.