CHARACTERIZING AND MONITORING CHANGES IN STATE OF POLYMERS DURING CURE AND USE-AGING

ANDREW ORSCHEL MEYER

College of William & Mary, Department of Applied Science, 2000
Field: Polymer Science, Degree: Ph.D.

Advisor: David E. Kranbuehl, Professor of Chemistry

Abstract

Multi Angle Laser Light Scattering (MALLS) and Frequency Dependent Electromagnetic Sensing (FDEMS) provide unique characterizations of polymer systems during cure and use-aging. This research demonstrates the MALLS is the most accurate technique for absolute characterization of macromolecules, giving molecular weight and size information that other widely used and accepted techniques are incapable of measuring. Application of MALLS to monitoring the changing state of a polyamide-11 system in a water aging environment led to the discovery of an equilibrium molecular weight which is the result of two competing reactions, hydrolysis-degradation and a newly discovered recombination-polymerization reaction. The discovery of this recombination reaction creates the possibility of an indefinitely healthy polyamide-11 polymer system. FDEMS successfully monitored changing water content and degree of cure of a moisture-curing adhesive polymer. The data show potential for total in situ cure characterization by FDEMS, including in situ determinations of moisture diffusion rates during a polymer cure in the adhesive bondline.