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Investigation of the Properties of Novel Carbon and Glass Fiber Filled and Unfilled Thiol-Ene Resins

Thiol-ene resins have been an interesting topic of study since the 1950s. Thiol-enes are advantageous over traditional photocured systems in that they exhibit low oxygen inhibition during curing, cure in the presence of both light and heat, and do not require a photoinitiator. Furthermore, by using multifunctional thiols and multifunctional enes, a crosslinked network can be formed. This network can contain hard and soft segments if more than one type of multifunctional ene is combined with a given thiol, giving the resulting product a variety of useful properties, including flexibility or strength. The addition of carbon or glass fibers to thiol-ene resins has the potential to improve the stiffness and strength properties of the systems. This preliminary study focused on the preparation and characterization of unique thiol-ene resins both filled and unfilled with carbon and glass fiber mat. Amounts of hard and flexible segment-producing enes were varied in the resins to observe the change in the properties of the systems. Due to various factors, the filled resins were not tested. Photo differential scanning calorimetry and real time infrared spectroscopy were employed to monitor the photopolymerization rates and functional group conversions of the unfilled resins. The triallyloxy-triazine based film showed a 10°C increase in stability over the triallyl-trione matrix. The resins exhibited interesting polymerization rate behavior as the amount of triallyl-trione was increased. Results revealed homopolymerization of the triallyl-trione as well as thiol addition across the double bond at high triallyl-trione concentrations.