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Multi-scale characterization of the plastic response in ionic-liquid modified epoxy networks

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Extended Abstract

Abstract

Understanding the mechanical response of glassy polymers under various loading conditions remains a major challenge in materials science. In particular the study of the yield behaviour of amorphous glassy polymers has attracted a lot of interest. However, the thorough link between molecular mobility and macroscopic yield behavior in glassy networks is still missing. This study focuses on the influence of ionic liquids (IL) addition on the stress-strain response of a reference epoxy-amine network, and more specifically on its yield stress dependence with strain rate and temperature. These systems were purposely designed to investigate how the nano-scale heterogeneity brought by IL addition influences the multiscale process leading to plasticity in glassy networks, through a combined approach mixing molecular mobility analysis and macroscopic mechanical characterization.The evolution of yield stress with temperature and strain rate was fitted using the Ree–Eyring model, accounting for the change of slope in the strain rate sensitivity at lower temperature or equivalently higher strain rates. In addition to morphology characterization by TEM, DMA and dielectric spectroscopy (DEA) have been performed to thoroughly characterize

the changes in molecular mobility at the network scale brought by the presence of IL. The ultimate goal will be to identify the origin at the molecular scale leading to the two identified rate regimes at the macro-scale. More generally, this work aims at providing new insights into the multiscale mechanisms governing plasticity in glassy polymer networks.

Keywords:

glassy polymer epoxy network ionic liquid plastic response molecular mobility