Effects of crosslinking on the linear viscoelastic response of industrial networks

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Shear rheology was used to investigate the effects of crosslinking on the linear viscoelastic properties of an industrial network consisting of an acrylate-based polymer and dual crosslinkers, permanent (epoxide) and reversible (metal-chelate). The dynamics of this system was compared with that of the single component (polymer without crosslinks) and that of the networks bonded by only physical and only chemical crosslinks. The relaxation spectrum and the thermal stability of the systems were studied by means of linear shear oscillatory tests. Creep experiments were used to extend the spectra to lower frequency range.

The experimental results show that fast processes and the plateau modulus of the systems are not affected by the presence of different crosslinks. On the contrary, the nature of the crosslink can alter the terminal relaxation mechanism which appears to be correlated not only to the disentanglements process but also to the association and dissociation processes of the bonds.

Understanding the dynamics and the physical properties of such complex networks is important for obtaining materials suitable for different applications.