SYNTHESIS AND DYNAMICS OF MODEL SUPRAMOLECULAR POLYMER NETWORKS

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Polymer gel and networks are fascinating versatile soft materials which are ubiquitous in daily life and high added-value applications. Today the biggest challenge is to combine and control within the same material all distinct features that makes them ideal for application. To address this challenge, a new type of polymer networks has been developed with the aim of combining at least two dynamics in the same material, giving rise to multiscale viscoelastic response under external stress or deformation field. Called Double Networks (DN),[1] they are formed by two interpenetrating chemically crosslinked polymer networks. They combine improved toughness and extensibility compared to the two individual networks. However due to the covalent crosslink, permanent damages under elongation are a major limitation. To answer this issue, hybrids DNs including a supramolecular network with large density of reversible bonds have been studied. Because of their very complex rate and time-dependent mechanical behavior, which depends on the dynamics of the transient network, they are not fully understood.

Our objective is to synthesize and study the dynamics of model fully supramolecular double networks (Figure 1). They are based on a combination of metal-ligand interactions, phase separation and entanglements. The first, long life time, network is made from ABA triblock copolymers with a long central block and small outer blocks to ensure phase separation with strong and stable association. The second, short life time, network is built from telechelic stars or long linear polymer bearing terpyridine ligands at the chain-ends or along the chain, and crosslinked by the addition of transition metal cations.[2] Here, we report on the synthesis of the ligand-functionalized and ABA triblock polymers by RAFT polymerization, and on the characterization of the two individual networks to fully understand the influence of the tailored bonds in the networks. These systems were studied by linear rheology in melt as well as in the solution according to different parameters such as composition, molar mass, ligand density, block length, nature of solvent ...

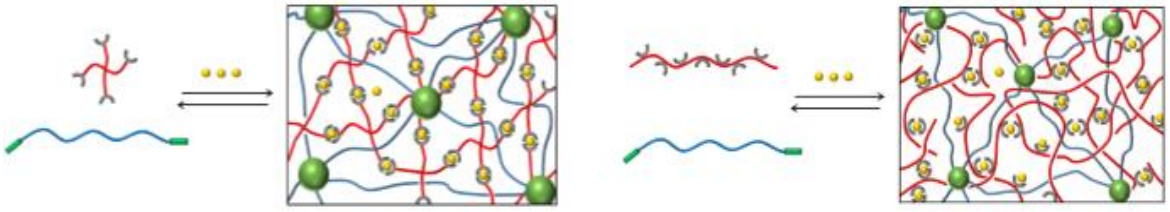

Figure 1: Schematic view of DDNs with ABA triblock and telechelic star or long linear polymer bearing terpyridine ligands

References :

[1] Chen, Q.; Chen, H.; Zhu, L.; Zheng. Macromol. Chem. Phys. 2016, 217 (9), 1022–1036.

[2] Zhuge, F.; Brassinne, J.; Fustin, C.-A.; van Ruymbeke, E.; Gohy, J.-F. Macromolecules 2017


INITIAL TRAINING NETWORK