# RHEOLOGICAL CONTROL OF MICROEMULSIONS IS POSSIBLE BY ADMIXTURE OF END-CAPPED MULTI-ARM POLYMERS OF DIFFERENT FUNCTIONALITY – A STUDY OF STRUCTURE AND DYNAMICS

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For many applications the interesting properties of microemulsion, which are thermodynamically stable mixture of oil and water facilitated by the presence of a surfactant, are highly interesting. However, for many of these potential applications a much higher viscosity or even gelation would be asked for. Accordingly, mixtures of telechelic polymers and microemulsions are interesting systems from a practical point of view as by the addition of the polymer one is able to exert rheological control over a rather wide range. Furthermore they are model systems of networks where concentration of nodes and connectivity can be tuned separately, which allows for a systematic understanding of the control of the rheological properties of these materials.

In our investigation we employed end-capped multi-arm polymers for the bridging of the microemulsion droplets which leads to network formation. For that purpose we employed tailor-made bridging amphiphilic polymers with multiple linkers, which were synthesized by the RAFT procedure with poly(N,N-dimethylacrylamide) (PDMA) as hydrophilic central block. This synthesis allows to control the number of arms (functionality), the length of the hydrophilic group (maximum length for connection) and of the hydrophobic chain (stickiness). We employed various multiply bridging polymers with 2, 3, or 4 arms (see figure) and investigated their effect on structure and dynamics of nonionic O/W microemulsion droplets with radii in the range of 2.5-7 nm.

SANS measurements show that the droplet size is not affected by the presence of the polymer, but it modifies systematically their interactions. In addition, DLS and high-frequency rheology were carried out in order study the dynamic properties of the mixed systems. These experiments show an increase of the interaction between the droplets with increasing polymer functionality and, of course, the dynamic properties and the macroscopic viscosity depend strongly on the number of stickers per droplet. Moreover, the elasticity of the network is correlated with the polymer architecture and in DLS increasingly complex relaxation patterns are observed with increasing number of polymer arms. In summary, one has comprehensive control over the rheological and dynamical properties of the micromulsions via the molecular architecture of the telechelic multi-arm polymers while retaining with the structural integrity of the droplets.

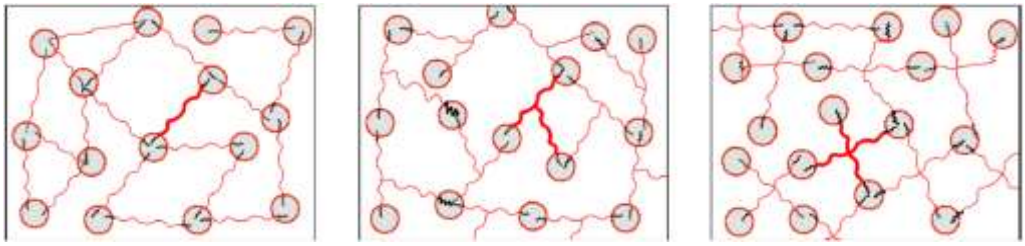

*Figure 1 – Scheme of microemulsion droplets connected by telechelic polymers of different functionality*