Investigations on the behavior of Thermo-responsive Block copolymers in Natural Deep Eutectic Solvents (NADES)

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Natural deep eutectic solvents (NADES) are a novel class of polar solvents that has the potential to become a non-toxic and cheap alternative to conventional organic solvents and ionic liquids. Amphiphilic self-assembly is very a well-established phenomenon for solutions of surfactants or amphiphilic polymers in water, allowing to functionalize them. [1] Structure formation by surfactants in DES has been studied to some extent, [2] but the solubility of polymers and in particular self-assembly of amphiphilic polymers is a topic that has been addressed to a very limited extent. [3]

Guided by extensive solubility assessments of various homopolymers, we have recently developed a system of the copolymer poly(acrylamide)-b-poly(N,N-dimethylacrylamide) (PAm-b-PDMAm), which self-assembles in the NADES Reline in a thermo-responsive way, leading to marked self-assembly at higher temperatures (Fig. 1 a). The copolymer exhibits enhanced viscosity and shear-thinning in Reline(Fig. 1 b), which can be tuned by adjusting block lengths, offering a means to control NADES properties.

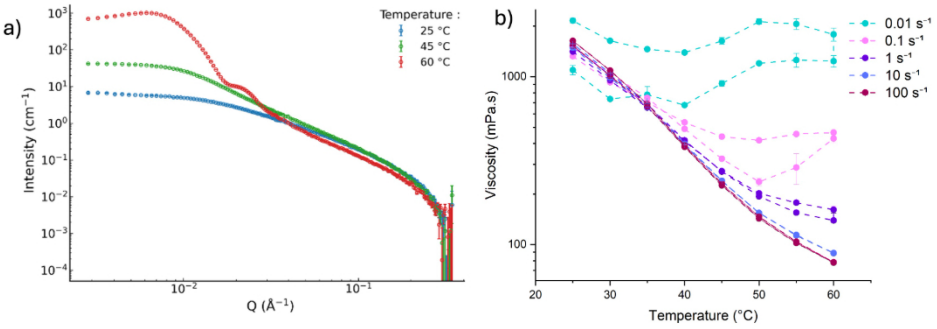

Fig. 1 (a) SANS profiles of PAm200-b-PDMAm300(5% w/w) in Reline at 25 °C, 45 °C, and 60 °C. (b) Temperature-dependent viscosity of PAm200-b-PDMAm300 (5% w/w) in Reline at different shear rates.

References:

[1] Vanda, H.; Dai, Y.; Wilson, E. G.; Verpoorte, R.; Choi, Y. H. *R. Chim.* **2018** , *21* (7), 628.Zheng, Y.-X.; Jiao, L.* *Nat. Synth* . **2022** , *1* , 180–187.
[2] Sanchez-Fernandez, A.; Moody, G. L.; Murfin, L. C.; Arnold, T.; Jackson, A. J.; King, S. M.; Lewis, S. E.; Edler, K. J. *Soft Matter* **2018** , *14* (27), 5525–5531.
[3] Patidar, P.; Kanoje, B.; Bahadur, A.; Kuperkar, K.; Ray, D.; Aswal, V. K.; Wang, M.; Chen, L. J.; Bahadur, P. *Colloid Polym.* **2021** , *299* , 117–128.