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Dynamics in Multicomponent Polyelectrolyte Solutions¹

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Double-network hydrogels (DN-gel) prepared from the combination of a moderately cross-linked anionic polyelectrolyte (poly(2-acrylamido-2-methyl-1-propanesulfonic acid), PAMPS) and an un-cross-linked linear polymer (polyacrylamide, PAAm) solution show strong mechanical properties far superior to that of their individual constituents [1]. To determine the origin of the superior properties of DN-gels, we investigated the structure and the chain dynamics of model PAMPS/PAAm solution blends using small-angle neutron scattering and neutron spin-echo measurements [2]. Akcasu's dynamic scattering theory for a multicomponent system [3] is modified to include polyelectrolytes, and the resulting equation describes well the neutron spin-echo results over the entire wavevector range covered in our experiments. Parameters such as effective solvent viscosity were deduced from the measured data using the modified Akcasu equation. Both the relaxation time at large length scales (10-100 nm) and the segmental diffusion coefficient at short length scales (0.1-1 nm) or the effective solvent viscosity show good accordance with the macroscopic rheological behavior of the solution blends.

[1] J.P. Gong et al., *Adv. Mater.* **15**, 1155 (2003).

[2] S. Lee et al., *Macromolecules* **42**, 1293 (2009).

[2] A.Z. Akcasu, in *Dynamic Light Scattering, The Method and Some Applications*; W. Brown Ed. (Oxford University Press, London 1992).

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