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Squishy stuff Probed by Small-Angle Scattering and Rheology

Friday 6 December 2024 09:00 (45 minutes)

The aim of our research is to achieve a fundamental understanding of compressible soft materials, both static and under flow, and use this knowledge to further develop bio-relevant colloids. An object's bulk modulus K quantifies its resistance to an isotropic compression. For deformable colloids, K must be known to predict their response to crowding. Here, we will first present a new approach to exert osmotic stress on soft objects using partially-deuterated, high molecular weight, polyethylene glycol [1]. In this study, microgels were used as a model system for soft compressible spheres and their bulk modulus was determined by means of small-angle neutron scattering with contrast matching. We then extended this study to probe the effect of softness under shear using (i) a 1,2-shear cell to study the shear banding phenomenon in suspensions of microgels [2], and (ii) then analysis unprecedented shear thinning behavior at extremely high shears using a capillary rheometer. Both shear cell environments are currently being developed at ESS together with collaborators from MaxIV.

[1] J. E. Houston, L. Fruhner, A. de la Cotte, J. Rojo González, A. Petrunin, U. Gasser, R. Schweins, J. Allgaier, W. Richtering, A. Fernandez-Nieves, A. Scotti. Resolving the different bulk moduli within individual soft nanogels using small-angle neutron scattering. Science Advances 8: eabn6129 (2022).
[2] G. Bassu, J. E. Houston, M. A. Lara-Pĕna, H. Kriegs, M. P. Lettinga, L. Porcar, A. Scotti, M. Laurati, Link between permanent shear-banding and local concentration fluctuations in suspensions of compressible microgels, under review (2024).

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