

Exercise sheet #8

The assignment for this week is to read the review paper posted on Moodle:

P. Cicuti and A. M. Donald, "Microrheology: a review of the method and applications" *Soft Matter*, 2007, 3, 1449–1455. DOI: 10.1039/b706004c.

This paper will be discussed during the exercise session this week. To help guide your reading and preparation for discussion, consider the following questions:

1. What is the main distinction between microrheology and conventional bulk rheometry? What advantages and limitations does microrheology offer?
2. How do passive and active microrheology differ in principle? What types of information does each provide?
3. The paper discusses the use of Brownian motion of probe particles to measure viscoelastic properties. How does the mean-square displacement (MSD) relate to the rheological parameters?
4. What are some challenges in probe particle selection (size, surface chemistry, etc.) for microrheology experiments?
5. How does microrheology account for heterogeneity in complex fluids, compared to bulk rheometry?
6. Discuss the assumptions behind the Generalized Stokes-Einstein Relation (GSER). Under what conditions might these assumptions break down?
7. What are the limitations of using microrheology for highly concentrated or strongly interacting systems?
8. The authors compare microrheology with conventional rheology. In which scenarios would microrheology provide unique insights that bulk rheometry cannot?
9. What are some biological or industrial applications of microrheology highlighted in the review? How does microrheology contribute to understanding these systems?
10. Can microrheology measurements be used to predict macroscopic rheological behavior, or are there limitations?