3D Flow Responses of Orientational Textures and Velocity Profiles of Charged DNA-virus Suspensions

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Abstract

The assembly of biomacromolecules can give rise to structures that carry important features giving rise to specific (dis-)function. Especially, the aggregation of anisotropically shaped macromolecules, such as fibers, rod-like molecules, and proteins can lead to considerable abnormality due to the formation of fibroligensis and amyloid plagues. A fundamental understanding of such self-assembly processes are imperative for a rational design of medicine against diseases resulting from such self-assembled structures. The mechanisms that play a role in the formation of these structures under non-equilibrium conditions can be (partly) unrevealed by studying the effect of external fields on structure formation. Here, a system of crowded rod-suspensions of charged DNA-virus (fd) at a low ionic strength (of 0.16 mM salt) is used as a model system the study structural arrest leading to glassy behavior and the response of such glasses to externally imposed flow conditions. In these glasses of very long and thin rod-like colloids, the glass transition occurs at concentrations far into the nematic state, where both the single- particle dynamics as well as the nematic-texture dynamics freeze. When subjected to flow, highly non-uniform flow profiles are observed: a fractured ”plug” flow, Taylor bands stacked in the vorticity direction, and gradient-banding. The flow profiles and the orientation texture dynamics are probed with an in-situ imaging and Laser Doppler heterodyne light scattering and an image-time correlation. The results highlight the effect of flow on structure formation in glass-forming liquids of the rod-like biomacromolecules.

Keywords: *Taylor bands and gradient banding, Charged DNA-virus rod-suspensions, Shear-deformation of orientational textures, Fluid velocity profiles, Heterodyne laser light scattering, Image-time correlation.*

Biography

Dr. K. Kang is a researcher in the Soft Condensed Matter group (ICS-3) in the Forschungszentrum Jülich, since 2007, after receiving her PhD in Physics at Kent State University, 2003, USA and postdoctoral fellowship in Institute of Complex System, at the Helmholtz Research Center in Jülich, Germany (2003-2007). She is investigating both non-equilibrium phase transitions (in electric field and shear-flow) and the equilibrium orientation dynamics of interacting charged chiral DNA-virus rods, as wel