

## CPP 95: Focus: Polymers under confinement II

Time: Thursday 15:00–16:15

Location: ZEU 222

CPP 95.1 Thu 15:00 ZEU 222

**Confined Glassy Dynamics in a Star-Shaped Polymer Induced by Crystallization: Case study of Polyhedral Oligomeric Polysilsequioxane - Isotactic Polystyrene (POSS-IPS)** — •MARTIN TRESS<sup>1</sup>, ARTHUR MARKUS ANTON<sup>1</sup>, MAXIMILIAN VIELHAUER<sup>2</sup>, PIERRE LUTZ<sup>3</sup>, ROLF MÜLHAUPT<sup>2</sup>, and FRIEDRICH KREMER<sup>1</sup> — <sup>1</sup>Universität Leipzig — <sup>2</sup>Universität Freiburg — <sup>3</sup>University Strasbourg, France

In semi-crystalline polymers, segmental motion is often constrained. While segments far away from the crystallites have unperturbed dynamics (mobile amorphous fraction), the segments in their proximity move significantly slower (rigid amorphous fraction). Here, we present a study combining broadband dielectric spectroscopy (BDS) and Fourier transform infrared spectroscopy (FTIR) which reveals the opposite effect in a star-shaped polymer, namely a faster mean relaxation time of the amorphous part in the semi-crystalline state [1]. A decomposition of the respective relaxation time distributions yields three fractions of different dynamics. These are assigned to a rigid amorphous fraction around the crystallites, a mobile amorphous fraction, and a confined amorphous fraction of enhanced dynamics presumably located around the POSS centers. Complementary FTIR measurements can address crystalline and amorphous moieties and trace their temperature dependence. These data sets give insight into the mechanism how the combination of crystallites and a star-like architecture constrains the dynamics in a way resembling spatial confinement.

[1] Tress et al. *Macromolecules* 51 (2018) 501-511

CPP 95.2 Thu 15:15 ZEU 222

**Polymer diffusion across lipidic nanochannels** — •REZA GHANBARI<sup>1,3</sup> and RAFFAELE MEZZENGA<sup>1,2</sup> — <sup>1</sup>ETH Zurich, Department of Health Sciences and Technology, Schmelzbergstrasse 9, CH-8092 Zurich, Switzerland; — <sup>2</sup>ETH Zurich, Department of Materials, Wolfgang-Pauli-Strasse 10, 8093 Zurich, Switzerland — <sup>3</sup>Present: Adolphe Merkle Institute, University of Fribourg, Chemin des Verdiers, CH-1700 Fribourg, Switzerland

We present an experimental investigation on the diffusion of unfolded polymers in the triply-periodic water-channel network of inverse bicontinuous cubic phases. Depending on the chain size, our results indicate the presence of two different dynamical regimes corresponding to Zimm and Rouse diffusion. We support our findings by scaling arguments based on a combination of blob and effective-medium theories and suggest the presence of a third regime where dynamics is driven by reptation. Our experimental results also show an increasing behavior of the partition coefficient as a function of polymer molecular weight, indicative of a reduction of the conformational degrees of freedom induced by the confinement. Further, the molecular diffusion is discussed across different symmetries, that is, double diamond (Pn3m) symmetry and the double primitive (Im3m) cubic phase.

CPP 95.3 Thu 15:30 ZEU 222

**Physics of driven DNA polymers in confinement** — •ULRICH KEYSER — Cavendish Laboratory, University of Cambridge, JJ Thomsen Ave, Cambridge, CB3 0HE, UK

Nanopore sensing has emerged as one of the most promising means for the analysis of single molecules. For DNA sequencing as well as molecule identification the physics governing molecular shape, velocity and fluctuations have to be understood and controlled. Here we show that we can design DNA molecules to measure velocity fluctuations during individual single molecule events [1]. The measurements reveal that friction between molecule, fluid and nanopore plays a crucial role. Based on these results we use electro-osmotic flow to force DNA to go through nanopores unfolded - facilitating molecular sensing [2]. Finally we investigated the details of polymer fluctuations and find that velocity and correlations crucially depend on the configurations of the molecules before initiation of translocation [3]. Our results guide efforts in developing DNA storage systems using nanopores [4].

[1] N. A. W. Bell, et al. Asymmetric dynamics of DNA entering and exiting a strongly confining nanopore. *Nature Communications*, 8:380, 2017. [2] N. Ermann, et al. Promoting single-file DNA translocations through nanopores using electroosmotic flow. *The Journal of Chemical Physics*, 149:163311, 2018. [3] K. Chen, et al. In preparation. [4] K. Chen, et al. Digital Data Storage Using DNA Nanostructures and Solid-State Nanopores. *Nano Letters*, 19:1210, 2019.

**Invited Talk** CPP 95.4 Thu 15:45 ZEU 222  
**Active Polymeric Liquid Crystals Under Confinement** — •JUAN DE PABLO — University of Chicago, Chicago, USA

Polymeric materials that comprise mechano-chemically active components are able to undergo spontaneous structural rearrangements that generate internal stresses and motion. These stresses can be particularly large in the case of liquid crystalline polymers, where elasticity becomes important. When confined, at intermediate to high concentrations such materials form nematic phases that are riddled with defects that serve as attractors for solutes or colloidal particles, and can be used for directed transport. Going beyond passive nematic systems, introducing internal activity in the form of molecular motors leads to the emergence of new structural and dynamical features that are not found in materials at rest. This lecture will focus on the relationship between structure, activity, and motion in confined lyotropic liquid crystalline polymeric systems that include colloidal particles. More specifically, results will be presented for actin and tubulin suspensions, where activity is generated by kinesin or myosin motors. A distinctive feature of these biopolymers is that characteristic contour lengths can range from hundreds of nanometers to tens of microns, thereby making them amenable for study by optical microscopy. By relying on molecular and meso-scale models, it is possible to arrive at a comprehensive description of these suspensions that helps explain the connections between molecular structure, the formation and shape of distinct topological defects, the localization of particles in such defects, activity, and defect dynamics.