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Real time SANS studies on the transformation from hexagonal cylinder phase to bi-continuous gyroid structure

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Combined application of small-angle neutron scattering and oscillatory shear instrumentation are effective tools for studying structure and real-time dynamics of soft matter materials. Applying well-controlled large-amplitude oscillatory shear can be used to effectively control the texture of soft materials in the ordered states. As an example, we present results on a body-centered-cubic phase of a block copolymer system, showing how a given textures can be controlled with the application of specific shear-rate and shear-amplitude[1,2]. Shear may also affect the thermodynamic ground state, causing shear induced ordering and disordering (melting), and shear-induced order-order transitions. We will present data showing that the gyroid state of diblock copolymer melts is unstable when exposed to large amplitude/frequency shear, transforming into the a hexagonal cylinder phase[3]. The transformation is completely reversibly, and with the relative slow kinetics in the transformation back from hexagonal to gyroid, it is possibly in detail to follow the complex materials transformation from one-dimensional cylinders to the complex three-dimensional bicontinuous networks expressed in the cubic gyroid phase of block copolymers.

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