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Formation and Characterization of Anisotropic Block Copolymer Gels CHYA YAN LIAW, DERK JOESTER, WESLEY BURGHARDT, KENNETH SHULL, Northwestern University — Cylindrical micelles formed from block copolymer solutions closely mimic biological fibers that are presumed to guide mineral formation during biosynthesis of hard tissues like bone. The goal of our work is to use acrylic block copolymers as oriented templates for studying mineral formation reactions in model systems where the structure of the underlying template is well characterized and reproducible. Self-consistent mean field theory is first applied to investigate the thermodynamically stable micellar morphologies as a function of temperature and block copolymer composition. Small-angle x-ray scattering, optical birefringence and shear rheometry are used to study the morphology development during thermal processing. Initial experiments are based on a thermally-reversible alcohol-soluble system that can be converted to an aqueous gel by hydrolysis of a poly(t-butyl methacrylate) block to a poly(methacrylic acid) block. Aligned cylindrical domains are formed in the alcohol-based system when shear is applied in an appropriate temperature regime, which is below the critical micelle temperature but above the temperature at which the relaxation time of the gels becomes too large. Processing strategies for producing the desired cylindrical morphologies are being developed that account for both thermodynamic and kinetic effects.

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