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Physical Structure of Methylcellulose Hydrogels
JOSEPH LOTT, JOHN MCALLISTER, SARA ARVIDSON, FRANK BATES, TIMOTHY LODGE, University of Minnesota — Methylcellulose (MC) is a chemically modified polysaccharide in which there is a partial substitution of hydroxyl groups with methoxy moieties. This results in a polymer that is water soluble at low temperatures and displays lower critical solution temperature (LCST) phase behavior at elevated temperatures. As such, aqueous solutions of MC have long been employed and studied due to their ability to form gels as temperature is increased. Currently, there is no consensus on the detailed mechanism of the gelation process, so a precise determination of the physical structure present in these materials may lead the way to new mechanistic understanding. Transmission electron microscopy (TEM) performed under cryogenic conditions is a powerful tool for the study of hydrogels as it allows direct imaging of the network while preserving the structure in the gel. Cryo-TEM investigations suggest that the hydrogel is composed of fibril-like aggregates comprising multiple polymer chains. Small-angle neutron scattering (SANS) provides a complimentary method to establish the detailed structure of the hydrogel network. We will report the effects of molecular weight, concentration, and temperature on the resultant physical structures within the gel.

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