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Anisotropic Poly(Vinyl Alcohol) Hydrogel: Connection Between Structure and Bulk Mechanical Properties[1] STEPHEN HUDSON, JEFFREY HUTTER, LEONARDO MILLON, WANKEI WAN, The University of Western Ontario, Canada, MU-PING NIEH, National Research Council Canada — Poly(vinyl alcohol) (PVA) hydrogels are formed from PVA solution by creation of physical cross-links during freeze/thaw cycling. By choosing a suitable freeze/thaw protocol and applying a strain during thermal processing, gels with permanent, anisotropic bulk mechanical properties matching those of cardiovascular tissues can be made, making them useful for applications ranging from artificial heart valves to vascular grafts. We have performed small- and ultra small-angle neutron scattering (SANS and USANS) measurements covering length scales from 2 nm to 10 μm, and modeled the structure as interconnected PVA blobs of size 20 to 50 nm arranged in fractal aggregates extending to at least 10 μm. Here, we discuss the relationship between the microstructure and bulk mechanical properties. Strength increases with the number of thermal cycles due to reinforcement of the small-scale gel phase, while anisotropy is due to elongation of the much larger fractal aggregates.

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