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Spider Silks-Biomimetics Beyond Silk Fibers: Hydrogels, films & Adhesives from Aqueous Recombinant Spider Silk dopes: A Synchrotron X-Ray Nano-Structural Study SUJATHA SAMPATH, University of Utah, JUSTIN JONES, THOMAS HARRIS, RANDOLPH LEWIS, Utah State University — With a combination of high strength and extensibility, spider silk's (SS) mechanical properties surpass those of any man made fiber. The superior properties are due to the primary protein composition and the complex hierarchical structural organization from nanoscale to macroscopic length scales. Considerable progress has been made to synthetically mimic the production of fibers based on SS proteins. We present synchrotron x-ray micro diffraction (SyXRD) results on new fibers and gels (hydrogels, lyogels) from recombinant SS protein water-soluble dopes. Novelty in these materials is two-fold: water based rather than widely used HFIP acid synthesis, makes them safe in medical applications (replacement for tendons & ligaments). Secondly, hydrogels morphology render them as excellent carriers for targeted drug delivery biomedical applications. SyXRD results reveal semi-crystalline structure with ordered beta-sheets and relatively high degree of axial orientation in the fibers, making them the closest yet to natural spider silks. SyXRD on the gels elucidate the structural transformations during the self-recovery process through mechanical removal and addition of water. Studies correlating the observed structural changes to mechanical properties are underway.

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