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Structure and applications of a temperature responsive recombinant protein hydrogel based on silk- and elastin-like amino acid motifs
LAWRENCE DRUMMY, MELANIE TOMCZAK, Air Force Research Laboratory, JOSEPH MACAULIFFE, Genencor Inc., RICHARD VAIA, RAJESH NAIK, Air Force Research Laboratory — Proteins form the main components of many natural materials, and they can be designed to offer tailored functionality and material properties. Silk elastin-like proteins (SELP)s come from a family of repeat sequence protein polymers based on *Bombyx mori* silk and mammalian elastin that are recombinantly expressed in *E. coli*. SELP gels are formed by heating the protein solutions in order to induce physical crosslinking of the silk β-sheet regions, they contain approximately 80-90% water by weight and they can be used for encapsulation of enzymes or nanoparticles. For example, horseradish peroxidase demonstrates added resistance to drying and heat treatment when encapsulated in the gel matrix. During gel formation, small angle X-ray scattering shows intensity increases in two distinct regions of reciprocal space, one reversible with temperature and one irreversible. By fitting the scattering data to a unified power-law/Gunier model, morphological parameters are extracted. The thermally reversible intensity changes are attributed to a hydrophilic/hydrophobic transition in the elastin segments, while the irreversible intensity change is due to the crystalline regions formed by the silk blocks.

Lawrence Drummy
Air Force Research Laboratory

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