Material Assembly and Gelation Kinetics of PEG-Heparin Hydrogels

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Abstract: Materials that are designed to mimic the structural and mechanical properties of the extra-cellular matrix are vital to tissue engineering. Recently, heparin functionalized polymer scaffolds have been synthesized to provide controlled sequestration and release of soluble molecules, such as growth factors. We use multiple particle tracking microrheology to investigate the material properties of these chemically crosslinked, synthetic hydrogel systems. The experimental system includes the crosslinker, linear dithiolyated poly(ethylene glycol), and the network backbone, maleimide functionalized heparin. Multiple particle tracking is performed using 1 um diameter poly(styrene) probe particles. Experiments capture the material response over short and long times. Gelation kinetics of the material are studied in the short times, while information about the final system properties are seen after the system has equilibrated. The critical gel point is determined using data collected for the time evolution of a single gelling system and time cure superposition [1]. The hydrogel composition and the functionality of the heparin are systematically varied to establish regions of gelation. With this information, we are able to create a quantitative library of material assembly conditions as a function of crosslinker to backbone ratio, backbone functionality and total polymer concentration for applications in tissue engineering.

[1] Adolf, D., Martin, J.E., *Macromolecules*, 1990, 3700.