Department of Materials Science and Engineering

Ph.D. Candidacy Exam

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Online (Zoom)
Zoom Link: https://drexel.zoom.us/j/710903347

Advanced Hydrogels for Additive Manufacturing

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Abstract:

Hydrogels have been recognized as one of the most important biomaterials for tissue engineering, medical implants and drug delivery. With the development of additive manufacturing technology, the application and study of hydrogels as bio-inks for 3D printing are attracting more and more interests. Benefiting from both 3D printing techniques and hydrogel material, 3D hydrogel printing could achieve fast, customizable and complex bio-manufacturing meanwhile provide essential biomechanical and biochemical environment for cells to proliferation and functionalization. However, the relatively poor mechanical properties of hydrogels are limiting the applications of hydrogels as bio-inks for 3D printing. Consequently, most researches in the field focused on the advancing of hydrogels to improve the biomechanical properties, increasing printing fidelity while maintaining biocompatibility. Four recently developed techniques as dual-crosslinked networks, interpenetration networks, nanocomposites and supramolecular hydrogels are analyzed as examples for advanced hydrogels for additive manufacturing in this discussion. The designs and performances of different techniques are discussed to compare the biomechanical properties, printability and fatigue resistibility. Trends and future perspectives are also discussed with two emerging techniques of co-printing and non-swellable hydrogel.