Enhancement of shape fidelity for 3D printed soft scaffolds by introducing hydrogen bonds

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3D printing of super soft scaffolds is difficult to accomplish because soft materials deform and collapse easily resulting in low shape fidelity.1 According to the report by Govindarajan,2 a UV curable low viscosity, ambient temperature printable polyester ink was developed in this work. The printed scaffolds fabricated from this composition had poor printing resolution and shape fidelity because the extruded filaments spread significantly leading to uneven pores before crosslinking. We reasoned that the print fidelity could be improved by hydrogen bonds in the composition. Secondary amide groups were introduced into the polymer inks to improve the printing resolution and shape fidelity. The hydrogen bonds formed between amide groups functioned as physical crosslinks and showed higher viscosity than the non-hydrogen bonded ink. This resulted in the significant improvement in printing quality of the hydrogen bonded ink. The rheological and mechanical tests for the UV crosslinked materials showed that the material’s moduli did not increase after introduction of hydrogen bonds.

The idea for enhancement of printing quality without sacrificing the softness of the scaffold by the introduction of physical crosslinks is relevant for issue related to 3D printing of polymer inks. This study demonstrates that introducing non-covalent interactions can be used as a strategy to significantly improve the print quality of soft scaffolds.

References

Biography:
Qianhui Liu is a Ph.D. candidate in Department of Polymer Science at The University of Akron, working with Prof. Abraham Joy. She obtained her B.S. at Beijing University of Chemical Technology in 2014, and her M.S. at The University of Akron in 2015. Her research involves designing, characterizing and using novel polyesters and polyurethanes in various applications, and she has interests in supramolecularly crosslinked polymers.
During her Ph.D., Qianhui has developed a series of polyesters to demonstrate the opposing effects of hydrogen bonding interaction and chain flexibility. In other projects, she has designed hydrogen bonding groups to modify poly(ε-caprolactone) and to enhance the shape fidelity of 3D printed soft elastomers. Through her research, Qianhui has formed a strong foundation in multi-step organic synthesis, characterization and elucidating structure-property relationships.