Rapid Prototyping of Biodegradable Tissue Engineering Scaffolds by Selective Laser Sintering of Polycaprolactone

Selective Laser Sintering (SLS) is a Solid Free Fabrication (SFF) technique that uses a laser beam to build objects by processing powder layers. SFF systems reduce the construction of complex objects to manageable, straightforward and relatively fast process. Objects can be formed with any geometric complexity or intricacy without the need for elaborate machine setup or final assembly. The overall goal of this research project is to sketch using Computer Aided Design (CAD) porous, three-dimensional structures and fabricate these designs using polycaprolactone (PCL), a biodegradable polymer and its composites hydroxyapatite (HA) and tricalcium phosphate (TCP). These scaffold structures will be built using an SLS machine.

Initially, we will design bone tissue engineering scaffolds using CAD and manufacture them using the SLS machine and PCL in order to find the best parameters to construct scaffolds. Next, we will construct tensile structures to test the strength of parts being built and ensure parameters being used are adequate. Subsequently, we will again generate various geometries of the bone tissue engineering scaffolds with PCL and change parameters used for build if needed. Finally, we will acquire HA and TCP powders and use it to create scaffolds containing PCL/HA and PCL/TCP blends.

This Project will result in a developed understanding of constructing complexly shaped, three-dimensional porous structures intended for use as tissue engineering scaffolds. These scaffolds created with PCL are biodegradable and will be tested to replace or help regenerate bones, tissues and muscles in various parts of the body. This project will contribute towards the success of research that will be conducted in Professor Das’ laboratory over the next several years. The work done by me during this project will be documented in a technical report that will be available to other members of Professor Das’ research group.