INDUSTRIAL SOLUTIONS LABORATORY

Department Project Information

Department Name	*MEES*	**Date Submitted**	*12/5/2022*
Project Title	*Development of 3D printing protocol of SiC screw with improved quality and analysis of bone cell response – BIOMED (UNCC_SCREW)*	**Planned Starting Semester**	*Spring 2023*

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	**Number**	**Discipline**	**Number**
Mechanical	4	Electrical	
Computer		Systems	
Other ( )			

Project Overview:

One of the most common injuries of the knee is the tear of the anterior cruciate ligament (ACL). A graft fixation device made of Titanium alloy (Ti6Al4V) or degradable polylactic acid polymer (PLA) is usually used for the reconstruction of the ACL. While Titanium alloy and PLA are biocompatible, they do not stimulate bone cell function or new bone formation. Moreover, the high stiffness of Ti alloy compared to bone creates a stress shielding problem. PLA degradation products are acidic. The accumulation of the acidic degradation products often lead to cell damage. Recent studies at UNC Charlotte focused on 3D printing of bioactive SiC screws that can serve as fixation device. The purpose of this project is to develop a protocol for 3D printing of SiC screws with improved reproducible quality and to test bone cell response to the material in vitro.

Project Requirements:

The students on this team are required to do the following:

- 3D print SiC screws using powder bed inkjet printer
- Develop a post processing protocol to optimize the mechanical properties of the 3D printed screws
- Seed the screws with osteoblasts and evaluate cell adhesion

Expected Deliverables/Results:

- 3D printing of screws with controlled reproducible threading accuracy
- Subject the 3D printed screws and cylinder samples to thermal treatment and measure the mechanical properties using three point bending and compression tests
- Analyze the phase composition by X-ray Diffraction analysis
- Seed the 3D printed samples with osteoblasts and analyze cell adhesion using SEM

Disposition of Deliverables at the End of the Project:

Hardware developed is the property of the mentor and department. Typically, the work product is displayed at the last Expo then immediately handed over to the mentor. Please confirm your expectation in this section.

List here any specific skills, requirements, specific courses, club affiliation, knowledge needed or suggested (If none please state none):

- BioMed concentration MEGR students