Design of a Low-Temperature Plasma Catheter for Future Cardiovascular Treatments

Overview
Endocarditis is a prevalent problem in the world today, and current treatments include using antibiotics or undergoing an invasive surgery. However, antibiotic resistant bacteria and the danger of valve replacement surgery show the need for a different and less invasive treatment. Plasma has been used to treat issues outside of the body, such as increasing the healing process of chronic wounds. The goal of this project is to create a catheter that can generate plasma within the body, right next to the location of the endocarditis in order to kill the bacteria.

Objectives
- Complete materials research, device design and manufacturing methods for a new catheter
- Create a testable prototype of a catheter that will be able to generate localized plasma

Approach
- First our team created a list of customer needs that our product required by looking into typical existing catheters
- We met with our sponsor in order to gain a full understanding of the desired outcome
- Using these customer needs we researched materials to use for the catheter body and for the wires inside of the catheter
- Several designs were thought of and discussed, and using concept selection the final design was chosen
- We then created the design in SolidWorks and sent it to a 3D printing company in order for them to print the body of the catheter
- The tungsten wires were wet etched and sent to the nanofabrication laboratory to be coated in 100nm of alumina for insulation
- The prototype was assembled using an epoxy
- Finally, the prototype was tested in a cuvette filled with water and visually observed for the generation of plasma

Outcomes
- Visual inspection showed that our catheter was able to generate plasma
- The sponsor now has information on how to create the prototype in the actual size with a larger budget than we were given
- The sponsor has our completed literature searches on materials, a list of companies that can manufacture this device, and contacts at the nanofabrication laboratory that are familiar with the project
- This prototype is a starting point, and can be improved or modified to create a less invasive and cheaper treatment method for endocarditis