UMD Department of Chemistry & Biochemistry
Spring 2021 Seminar Series
Friday, March 5, 2021
3:00 p.m. Chem 200/Remote Via Zoom

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Characterization of Porous Polyvinylidene Fluoride for Use as a Biosensor

The Transcatheter Aortic Valve Replacement (TAVR) is a minimally invasive procedure that has grown in popularity in recent years. However, there has been documentation of many complications after this procedure, such as a mortality rate of 8.4% for TAVR procedures compared to 4.8% for tissue surgery procedures after 90 days for Medicare beneficiaries. The underlying mechanisms of the TAVR procedure and how the replacement valve changes the biomechanical and flow environment after implantation has not been well studied. Therefore, it is necessary to design a model heart and create sensors to understand the underlying mechanisms of the TAVR procedure. The goal of this project is to design a sensor that can detect changes in blood pressure and blood flow rates in a silicon model heart. One promising type of material is piezoelectric sensors. Piezoelectric materials take mechanical stress and create detectable changes in voltage that can be calibrated to determine changes in pressure. One material that has been used for other sensors is Polyvinylidene fluoride (PVDF). This study will investigate how porosity of PVDF changes the structural and mechanical properties of the polymer. Pores will be introduced into the PVDF membrane by adding Zinc Oxide (ZnO) nanoparticles during the synthesis process and removing the ZnO particles once the membrane has dried. To study the changes in the structure of the membrane, Scanning Electron Microscopy is used to confirm a porous structure. To study how the chain conformation of the polymer changes with porosity, Fourier Infrared Spectroscopy is utilized. A Tensile Tester is used to apply compressive stress onto the PVDF membranes to study the piezoelectric output. To allow for comparison between various porous membranes, the d33 coefficient is calculated. This will help determine which porosity is optimal for the creation of the biosensor with desired sensitivity.