GRADUATE STUDENT RESEARCH SEMINAR SERIES (2018)

A NOVEL APPROACH FOR THE SUSTAINABLE SYNTHESIS OF CARBON FIBERS

SPEAKER: DEVIN KECK

Presented here are preliminary experiments facilitating the use of the cellulose-extruding bacteria *Gluconoacetobacter xylinus* as a sustainable tool for the production of carbon fibers. *G. xylinus* has the inherent ability to convert different kinds of sugars into highly crystalline cellulose nanofibrils. The random movement of the bacteria within the cellulose culture leads to a porous cellulose scaffold with no apparent order. Additionally, bacterial cellulose has higher purity and exhibits superior mechanical properties when compared to the cellulose extracted from plants.

Currently, we are developing a platform that has the capability to position *G. xylinus* cells using light induced Dielectrophoresis (liDEP) to grow cellulose fibers from specific locations, which will then be carbonized to create individual carbon fibers. DEP refers to the movement of electrically polarized cells in response to a non-uniform electric field of specific frequency and magnitude. Specifically, positive DEP will be used here to position, the bacteria in a continuous flow of nutrient-rich media, allowing for the continuous extrusion of straight fibers. The ultimate goal is to develop a scalable platform for the continuous production of cellulose nanofibers that can then be converted to carbon. This would become a more sustainable alternative to current practices of cellulose production by eliminating the cost and energy required for forest management, cellulose extraction, and cellulose purification. Most importantly, it eliminates the use of oil in the production of carbon fibers.

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