Name: Wewers III, Frederick J.

Education Institution:
Clemson University/Chemical Engineering/BS 2013

NASA MSFC Mentor:
James M. Mansell MSFC-ES62

Research and Experience

- **Palmetto Academy,** Clemson University, Research with Dr. Christopher Kitchens (5/10-8/10)
  - Synthesized cellulose nanocrystals (CNC) dispersed in poly-lactic acid (PLA) to enhance desired mechanical properties of PLA
  - Developed melting and synthesis methods for PLA-CNC mixtures
  - Gained experience with various lab equipment and procedures

Membership and Activities

- Member of Clemson University Drumline (2009 – Present)
- Captain of Winter Percussion Ensemble (2008 – Present)
- National Society of Collegiate Scholars (2009 – Present)
- National Honors Society – 2006 –2009
- American Institute of Chemical Engineers (2009 – Present)
- Marching Band and Drumline
- High School Drumline Captain for Two Years
- Duct-Tape Hammock Competition
- Tau Beta Pi Engineering Honors Society (2010-Present)

Honors and Awards

- 3.91 GPA after 1st semester Sophomore Year
- Westside High School Salutatorian (2009)
- Clemson Coca-Cola Scholar
- President's List for Academic Achievement
- Science Experiment on Synthetic Engine Lubricants and the Desired Properties- Gold Award at AOP Regional Science Fair and on to National Science Fair
- Science Experiment on Aerodynamics in Derby Cars - Gold Award at AOP Regional Science Fair and on to National Science Fair
- Gold Award at AOP Regional Science Fair for Science Experiment on Concrete and the effect of changes in amount of water have on the strength of the concrete - on to National Science Fair

Exploration of a 2-Stage System for CO_2 Reduction via the Bosch Process

Open-loop atmosphere revitalization (AR) systems are unfavorable for long-term missions beyond low Earth orbit (LEO) due to incomplete mass recovery. These AR systems vent carbon dioxide (CO_2) overboard and require resupply of oxygen and carbon. To improve mass recovery, CO_2 reduction systems are currently being developed by NASA. The state-of-the-art Sabatier system reacts CO_2 and H_2 over a transition metal catalyst to produce methane (CH_4) and water. In contrast, the Bosch process uses a metal catalyst to react CO_2 and H_2 to produce solid elemental carbon and water. Taking carbon to its elemental state allows for complete recycling of both the hydrogen and oxygen in the form of water, unlike the Sabatier reaction which would have to waste hydrogen in the vented methane. However, current Bosch systems are burdened by high power consumption due to large heating and recycling requirements, and by considerable catalyst resupply needs. To increase the efficiency of the process, NASA MSFC is investigating the possibility of a two-stage reactor system to separate the process steps. This separation will allow optimization of each component reaction in the Bosch process, resulting in maximum efficiency. This paper describes the construction and maintenance details of the Series-Configured Bosch Catalyst Test Stand as well as testing of single-stage and two-stage Bosch reactor systems at various pressures with steel wool and nickel shaving catalysts.