



2021 Virtual HBCU-UP/CREST PI-PD  
Meeting



# CREST Center for Bioenergy, *North Carolina A&T State University*

Debasish Kuila, Research Dir & Thrust II Leader  
Ghasem Shahbazi, PI and Center Director  
Shamsuddin Ilias, Co-PI & Thrust Leader  
Lijun Wang, Co-PI & Thrust leader  
Keith Schimmel, Co-PI & Education Director

This project is supported by the National Science Foundation grant

**CREST Center award: 1736173**

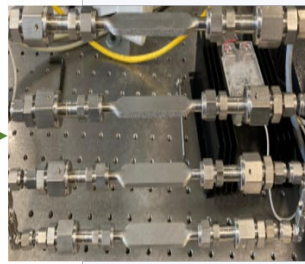
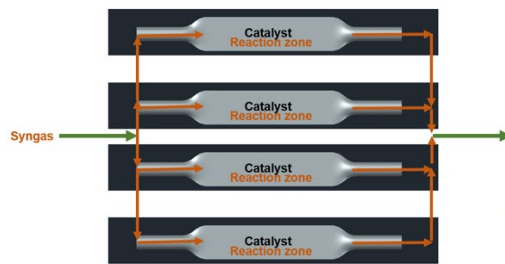
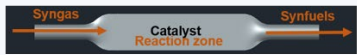
All findings and opinions are those of the authors, not necessarily of the funding agency or AAAS.

# Overview- Fischer-Tropsch (F-T) Synthesis & Steam Reforming of Methanol(SRM)

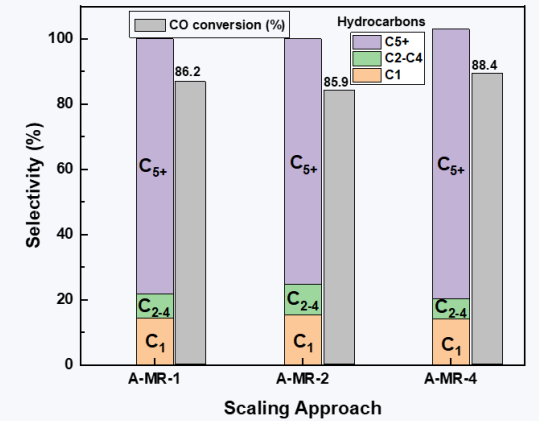
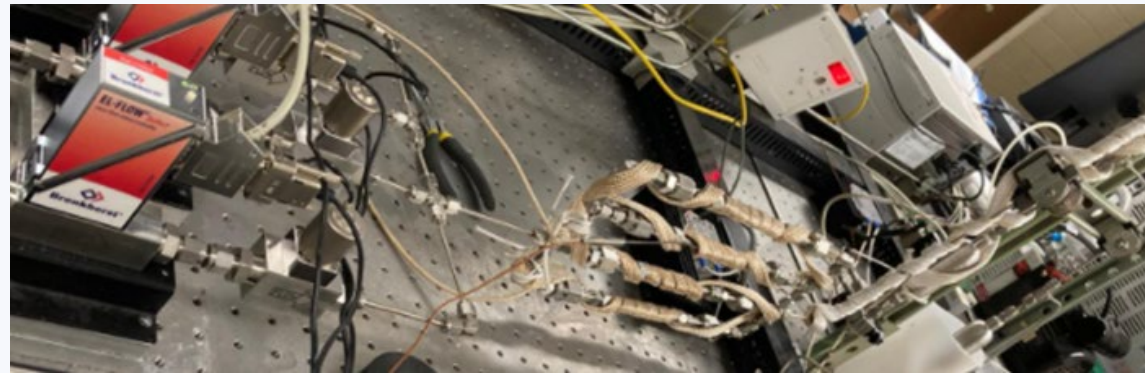
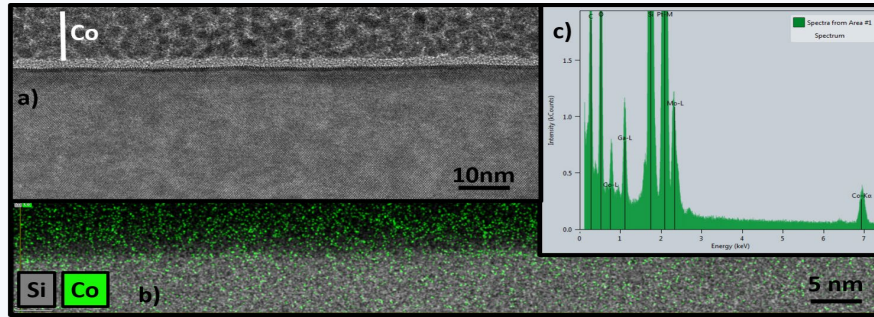
## Accomplishments:

- Designed, built and demonstrated F-T synthesis in 3D-Printed stainless steel (SS) Microreactor at 1 bar and 20 bars. We have tested several traditional and novel Fischer Tropsch catalysts.

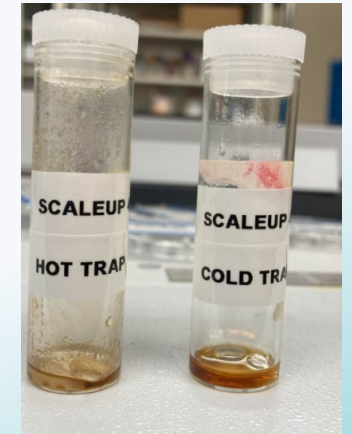
cobalt-based catalyst before & after anodic bonding →



AutoCAD design and the final 3D printed part of the microchannel microreactor



Comparison of catalyst performance in three types of reactor assembly at 240 °C, H<sub>2</sub>/CO (2), 20 bar, ~6000 GHSV



Liquid synthetic fuel collected from hot and cold traps

# Best Practices/Successes

- NSF AGEP-NC Model of Change is being implemented to train faculty to mentor graduate students in the CREST Center for Bioenergy.
- Entrepreneurship workshop - led by Dr. Liang, Distinguished Professor, College of Agriculture, NCA&T, June 1-5, 2020.



**Purpose**- introduce CREST students to innovation and entrepreneurship associated with bioenergy and its application to industry.

**Activities** – students worked in groups of three to generate product ideas and prepare a business plan for commercializing their products.

- Recruited young faculty from the Chemistry & Chemical Eng. Departments
- Established a partnership with **Lawrence Livermore National Lab (LLNL)**. A graduate student completed a summer internship with Drs. Jeremy Feaster and Marcus Worsley, in 2020 at LLNL that involved nano-structured materials in SS Microreactor for synthesis of biofuels.

# Implications

- A student worked at Lawrence Livermore National Lab to fabricate nano-structured materials and catalysts.
- Student working at the Advanced Biofuels lab, RTI, NC to assist with data analysis.
- Leveraged funding from the State (ROI) and NSF (I-Corps).
- Submitted two Reports of Invention disclosures relevant to design and fabrication of microreactors and combined approaches for biofuel production using 3D Printed Catalysts.
- High quality publications (15 peer-reviewed, 4 book chapters).

# Identified Gap(s) for Future Collaboration or Enhancement

Modeling of Microreactors has been identified as a gap in bioenergy research.

- Numerical modeling by Dr. Omar Basha of ChemE to investigate scale-up pathways for the production of renewable fuels through F-T synthesis in micro-channel reactors is exciting.
- Discussion with the CEO of Cree, Inc, based in NC, is underway; he is interested in our microreactor technology for product development.

Comparison of Microreactor productivity with existing reactor technologies highlighting potential benefits from effective scale-up/numbering-up

