

# Recent Electrocatalyst Work at NETL

Thuy-Duong Nguyen-Phan<sup>1,2</sup> and Douglas R. Kauffman<sup>1</sup>

<sup>1</sup> National Energy Technology Laboratory, 626 Cochran Mill Road, P.O. Box 10940, Pittsburgh, PA 15236-0940, USA

<sup>2</sup> Leidos Research Support Team, 626 Cochran Mill Road, P.O. Box 10940, Pittsburgh, PA 15236-0940, USA

Research &  
Innovation Center

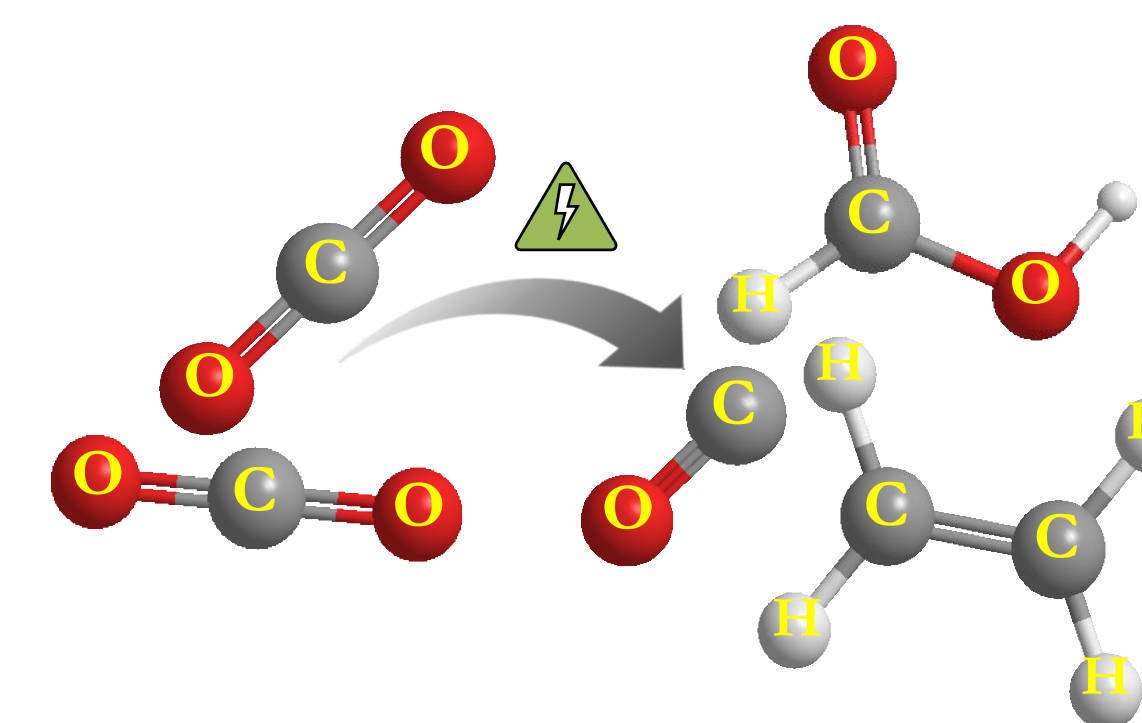


## Electrocatalyst Design



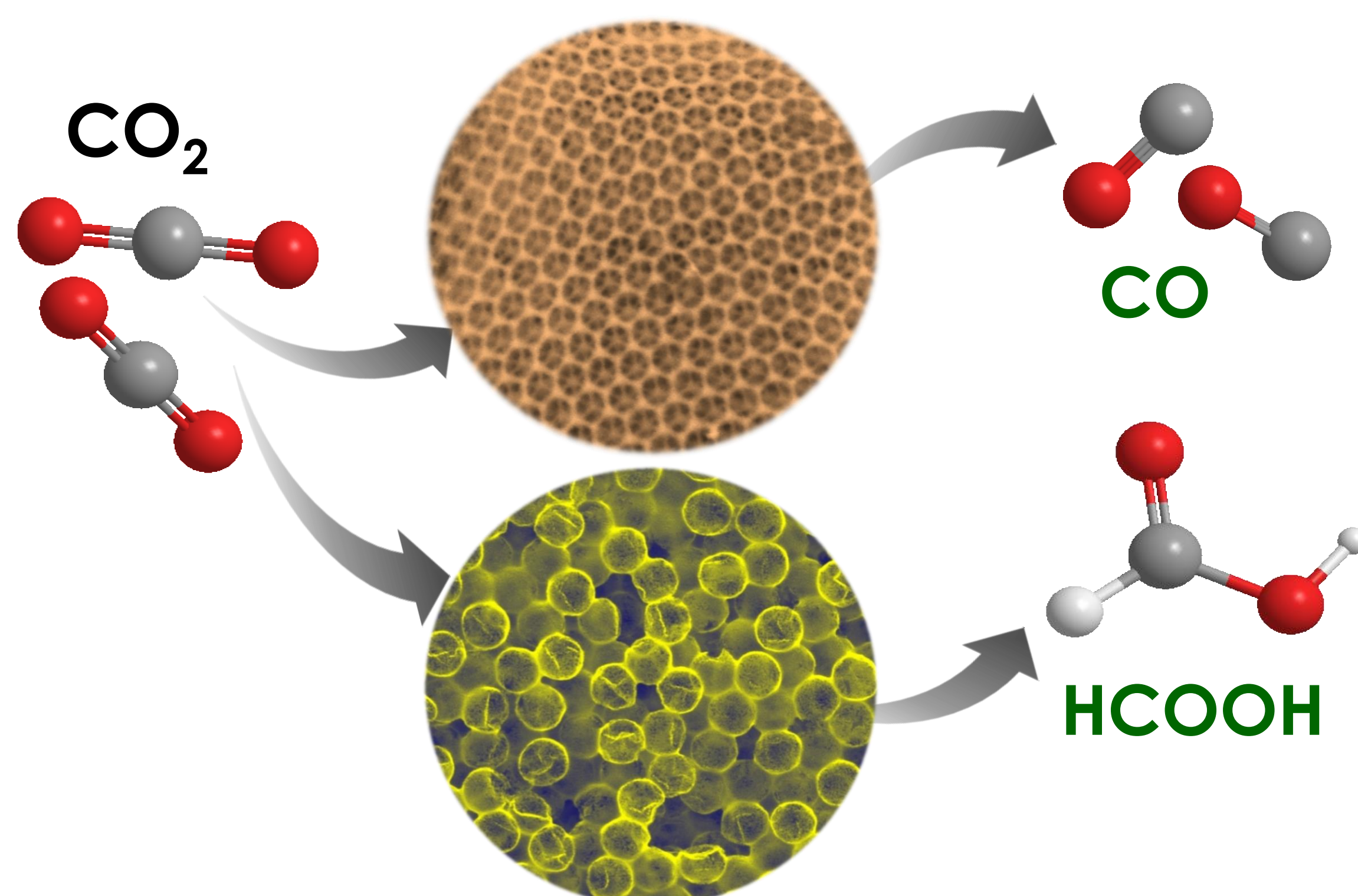
- 10 years of early-stage research
- Establish structure-property relationships and develop high activity catalysts

## Converting waste CO<sub>2</sub> into value-added chemicals and fuels



Controlling catalyst morphology and composition to reduce or eliminate precious metals

## Structure-Enhanced Catalysis

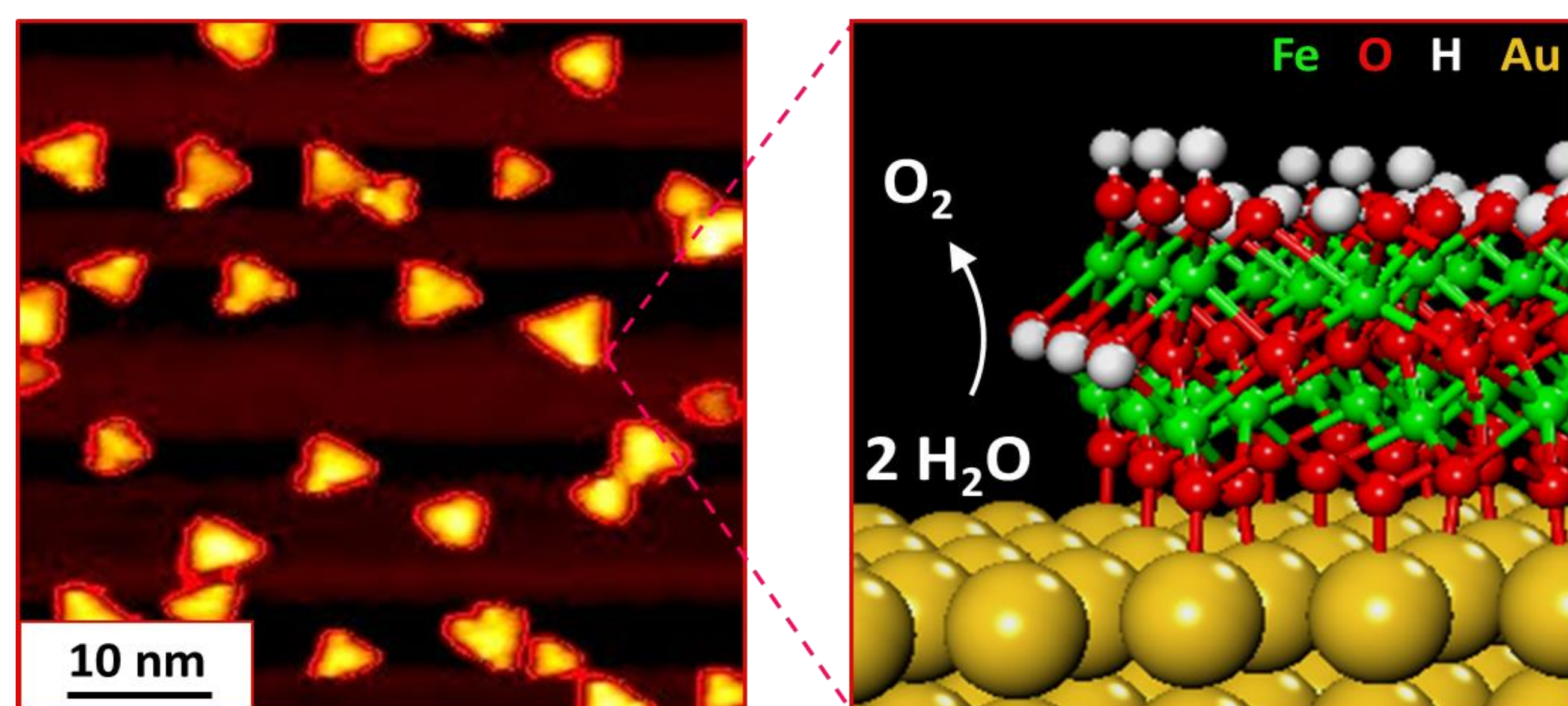


### Using 3D morphology to tune selectivity and boost activity

- ~90% selective CO production with >72% Faradaic efficiency from CuO inverse opal catalysts
- 6-fold activity enhancement from SnO<sub>2</sub> nanospheres and stable long-term performance over several days

*J. Mater. Chem. A* 2019, 7, 27576

## Surface-Science Enabled Electrocatalysis



Precisely identify and quantify important reaction centers

*ACS Catal.* 2019, 9, 5375

## Atomically-Precise Nanocatalysts



Unique structures reduce or eliminate need for precious metals

*ACS Catal.* 2016, 6, 1225

*J. Phys. Chem. C* 2018, 122, 27991

## Acknowledgement

This work was performed in support of the US Department of Energy's Fossil Energy Carbon Use and Reuse Program. The Research was executed through the NETL Research and Innovation Center's CO<sub>2</sub> Utilization Technology Field Work Proposal. Research performed by Leidos Research Support Team staff was conducted under the RSS contract 89243318CFE000003.

## Disclaimer

This work was funded by the Department of Energy, National Energy Technology Laboratory, an agency of the United States Government, through a support contract with Leidos Research Support Team (LRST). Neither the United States Government nor any agency thereof, nor any of their employees, nor LRST, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.