



## CO<sub>2</sub> capture research in the Pittsburgh region

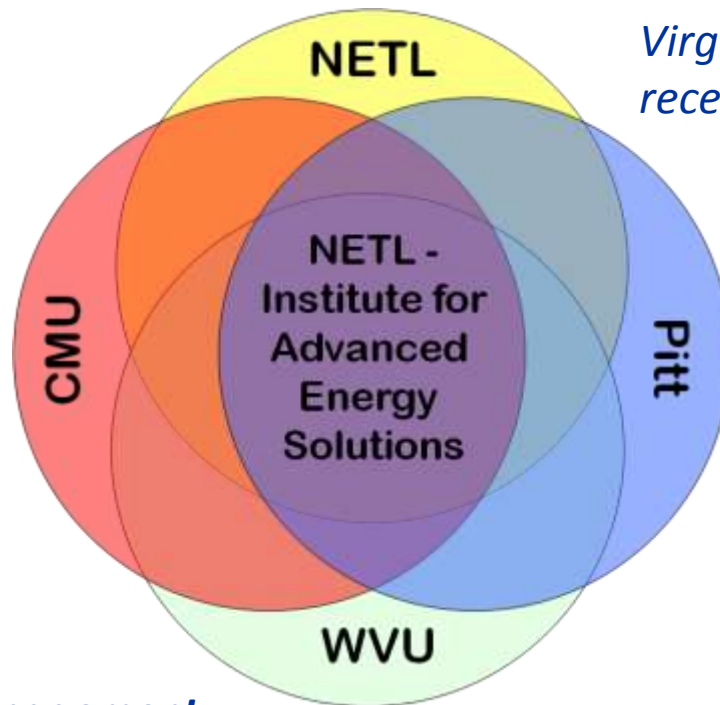
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*National Energy Technology Laboratory*

Carnegie Mellon University

*This technical effort was performed in support of the National Energy Technology Laboratory's ongoing research in CO<sub>2</sub> Capture Under the RDS contract DE-AC26-04NT41817*

# NETL-Regional University Alliance



*Virginia Tech and Penn State recently joined our team.*

*1. Materials*

*2. Process modeling*

*3. Catalysis*

*4. Carbon Management*

*5. Sensors*

*6. Energy Conversion Devices*

*7. Hydrates*

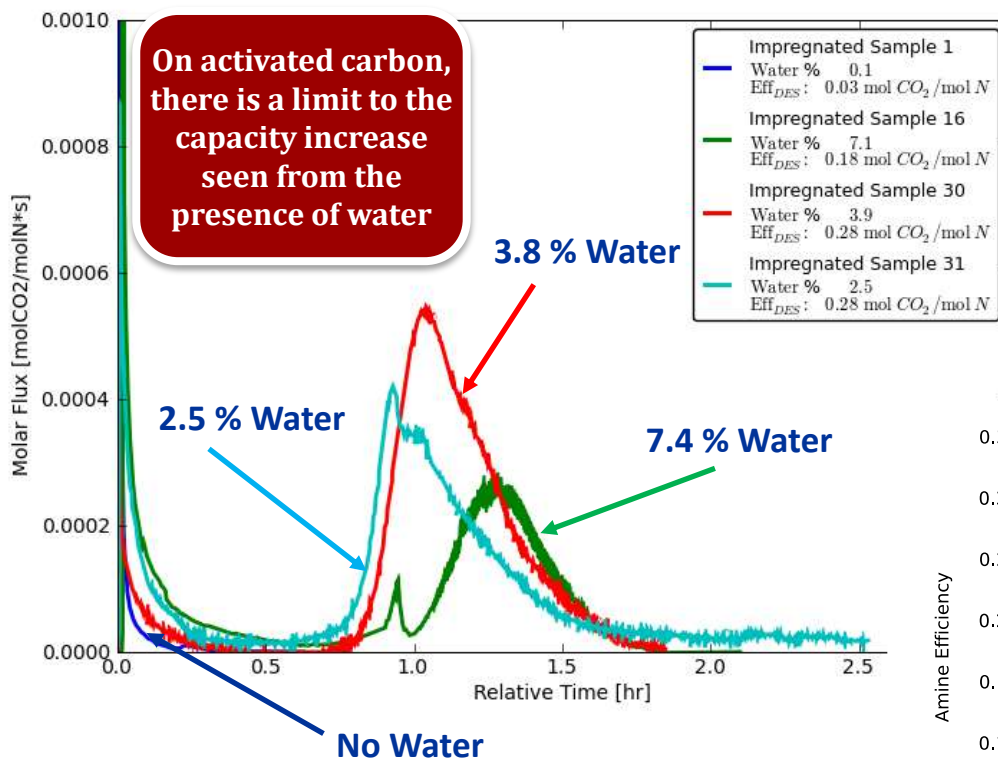
*8. Deep oil and gas*

*9. Water management*

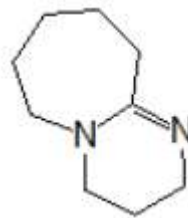
*10. Combustion*

*40 Resident Institute Faculty Fellows, ~160 Institute Researchers. Direct collaborations between multiple Universities and NETL*

# Role of Humidity in the adsorption capacity

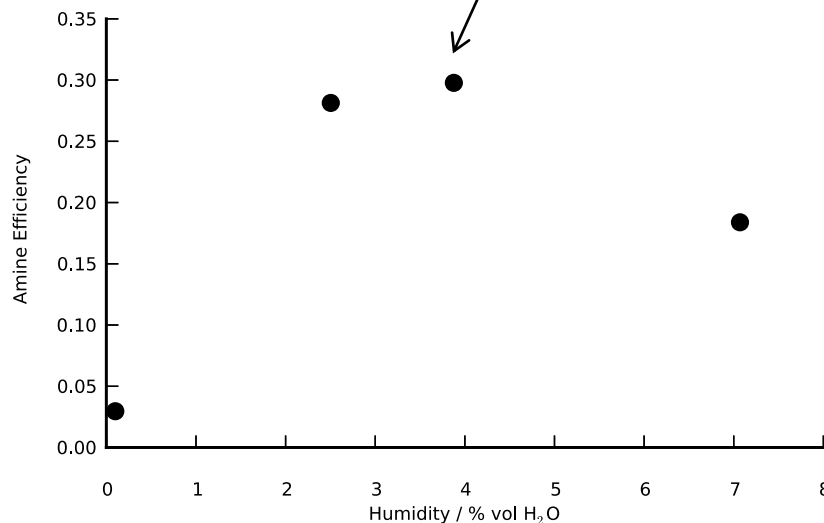


Thermal regeneration at 80°C



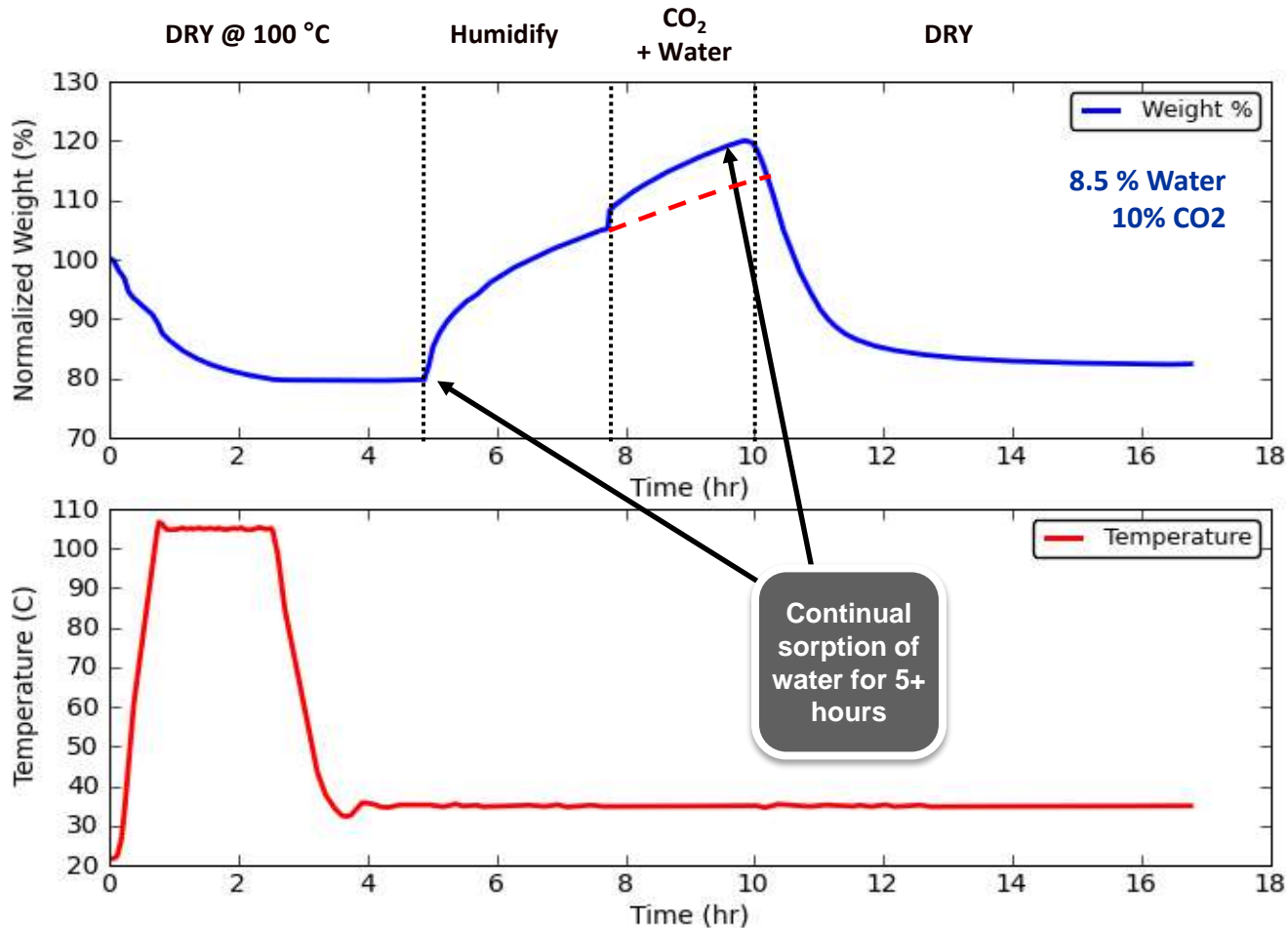
Supported molecular amine

Peak in capacity at 3.8% water



*Anhydrous operation results in no CO<sub>2</sub> capture*

# Thermogravimetric analysis of moisture sorption

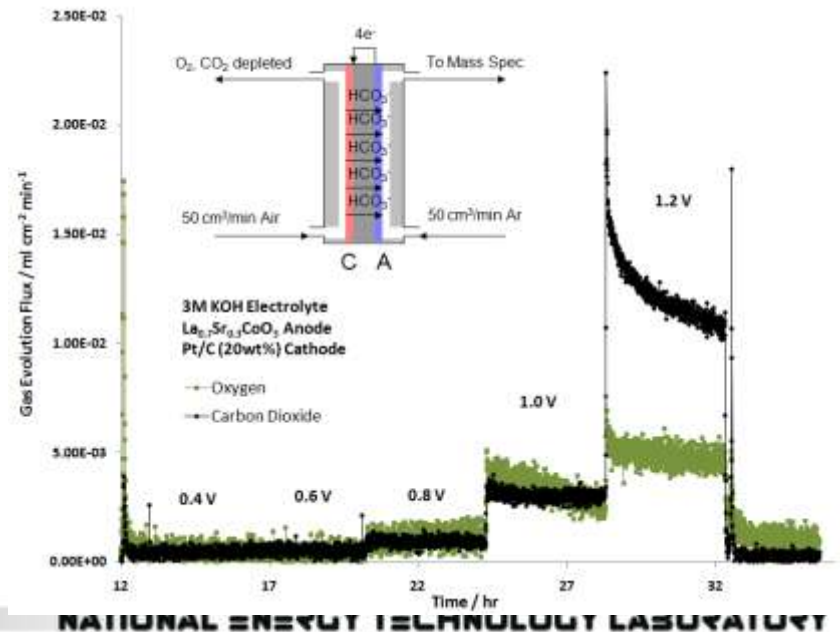
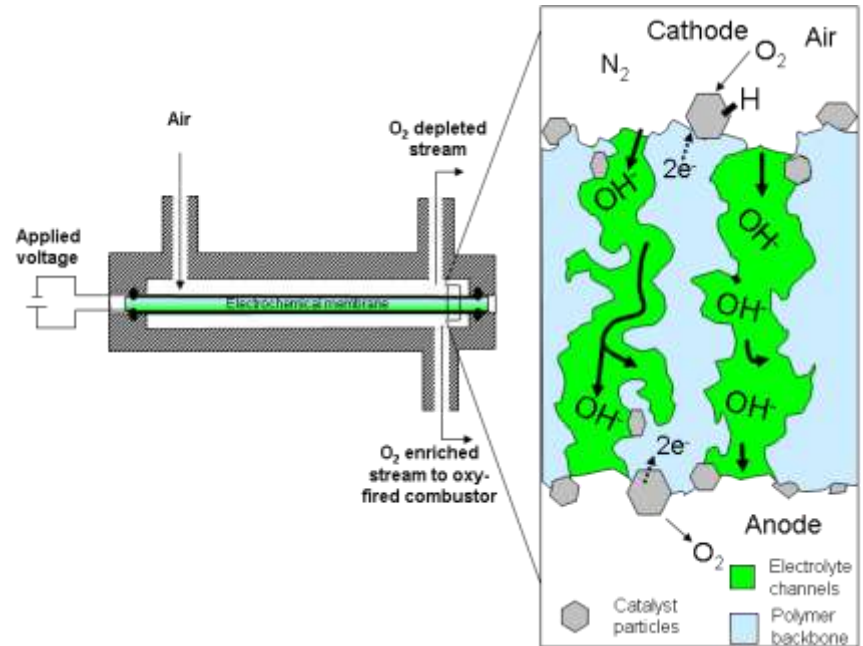


Hydrophilic activated carbon resulted in continual water sorption over long time scales, leading to pore blocking and reduced apparent capacity

# Oxygen evolution electrocatalysis enables

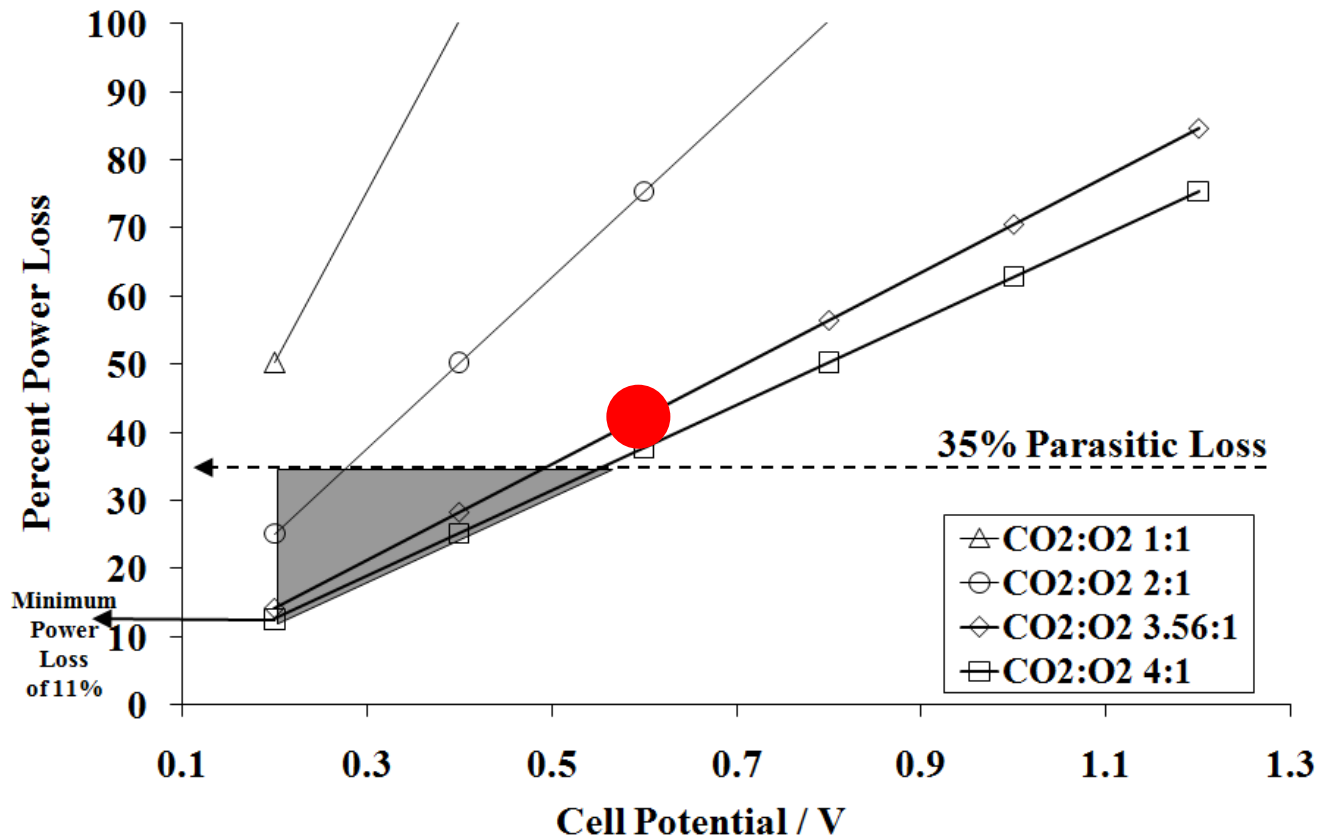
- Oxygen purification from air for oxycombustion
- Post-combustion CO<sub>2</sub> capture
- Water electrolysis for hydrogen production
- Electrochemical fuel synthesis (chemical energy storage)

*We are developing novel multifunctional oxide electrocatalysts and membrane electrode assemblies to enable this technology*



NATIONAL ENERGY TECHNOLOGY LABORATORY

# Integrated post-combustion CO<sub>2</sub> capture with auxiliary oxy-combustion

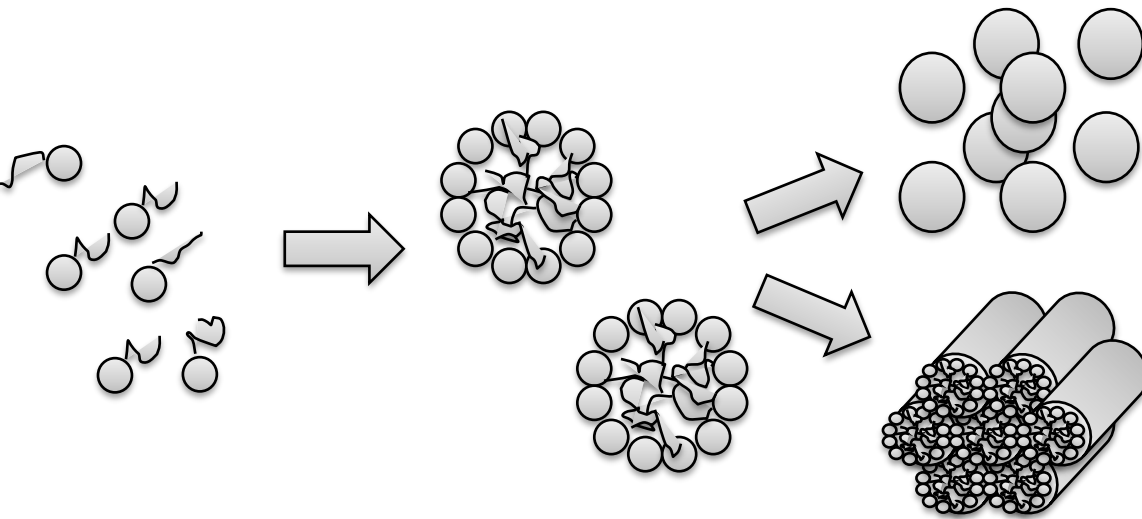


Assumptions:  
 500 MW Power  
 40% Efficiency  
 75% C Content  
 24 MJ/kg Coal  
 Complete Combustion

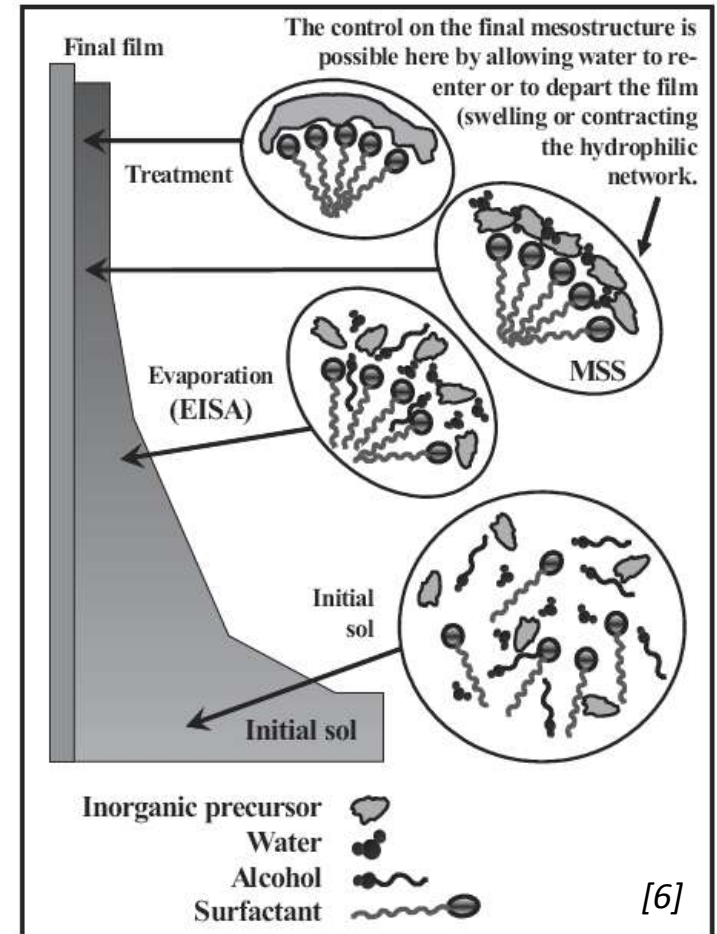
*Increases in the CO<sub>2</sub>:O<sub>2</sub> ratio and decreases in the cell potential through catalyst development will lead to separations in the capture window shown in gray.*

# Novel infiltration vehicles for SOFC cathodes

## Evaporation-induced self assembly

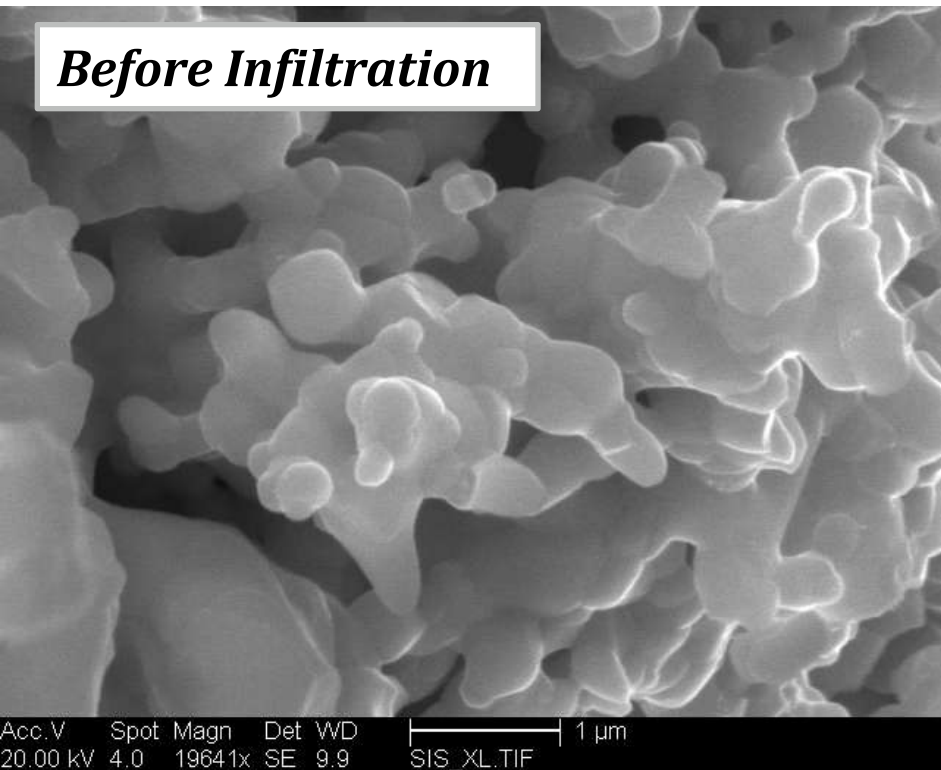


- ▶ Surfactant phase behavior leads to mesoporous, high surface area materials
- ▶ May lead to enhanced catalytic activity

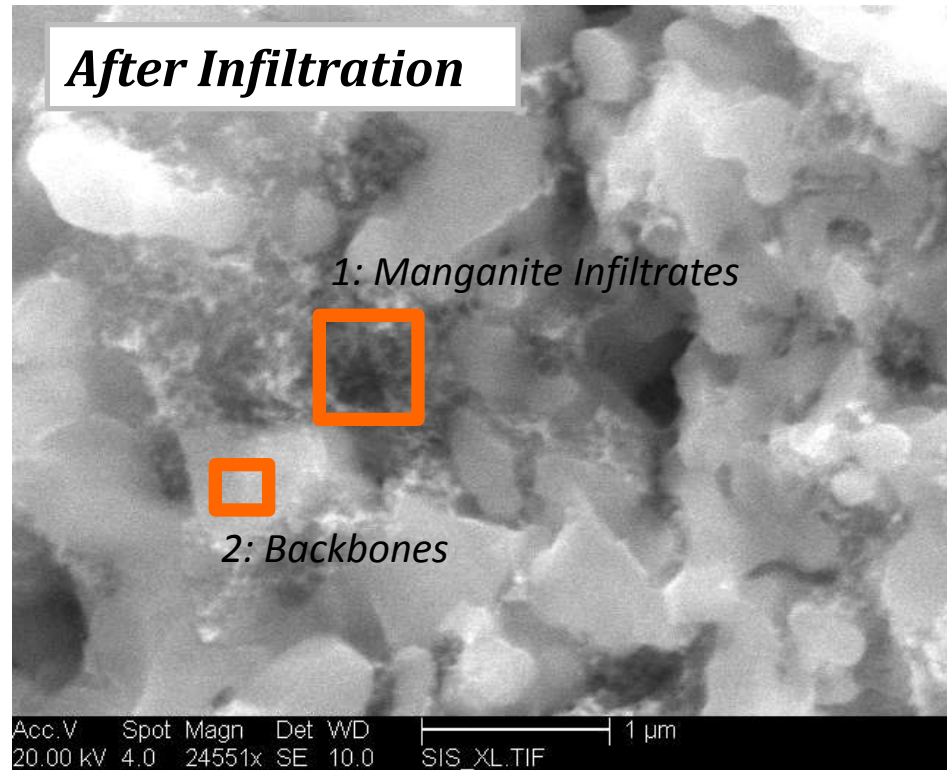


# MSRI LSCF Baseline Infiltration

*Before Infiltration*



*After Infiltration*



- The smaller feature-size particles are from EISA infiltration
- Performance testing to come

## EDS Data

Area	Mn (at%)	Fe (at%)
1	17.76	19.03
2	0	35.64