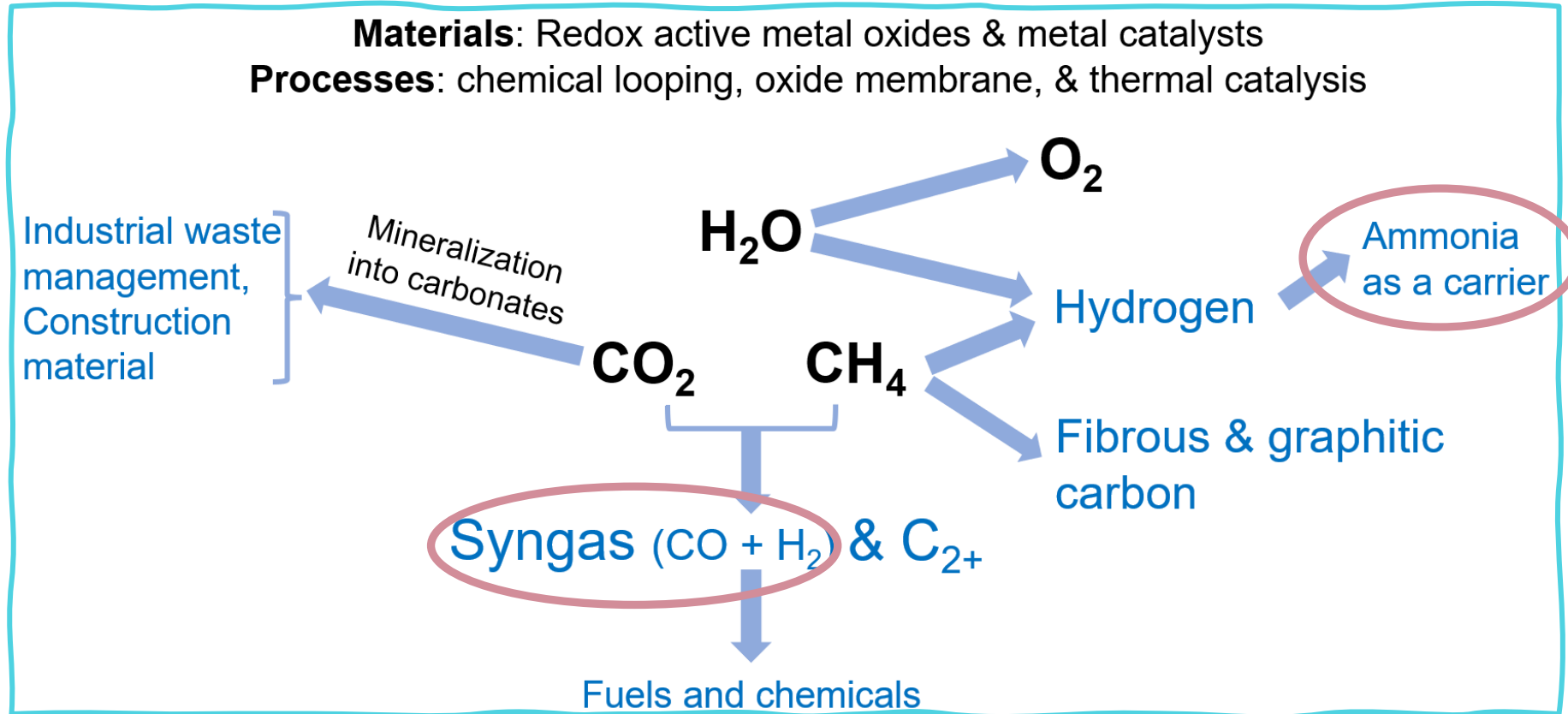


Materials and Systems for Thermochemical Energy Technologies



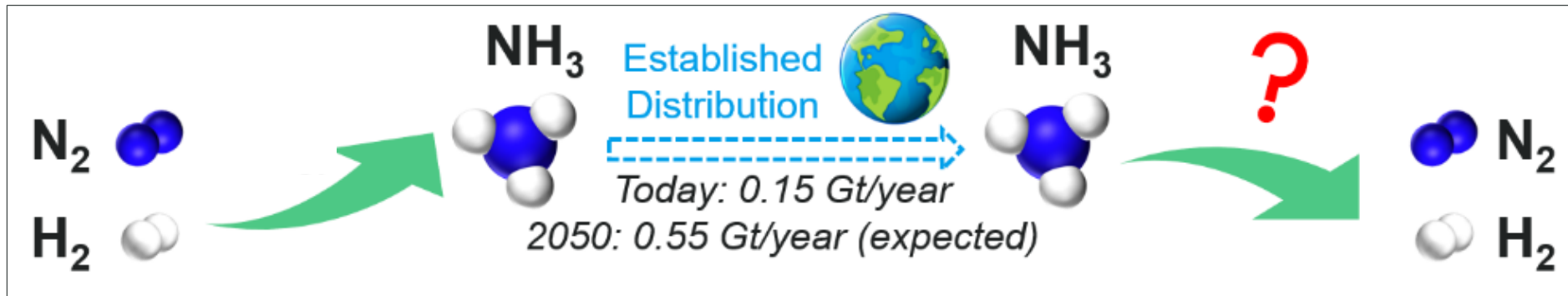
Shang Zhai

Assistant Professor

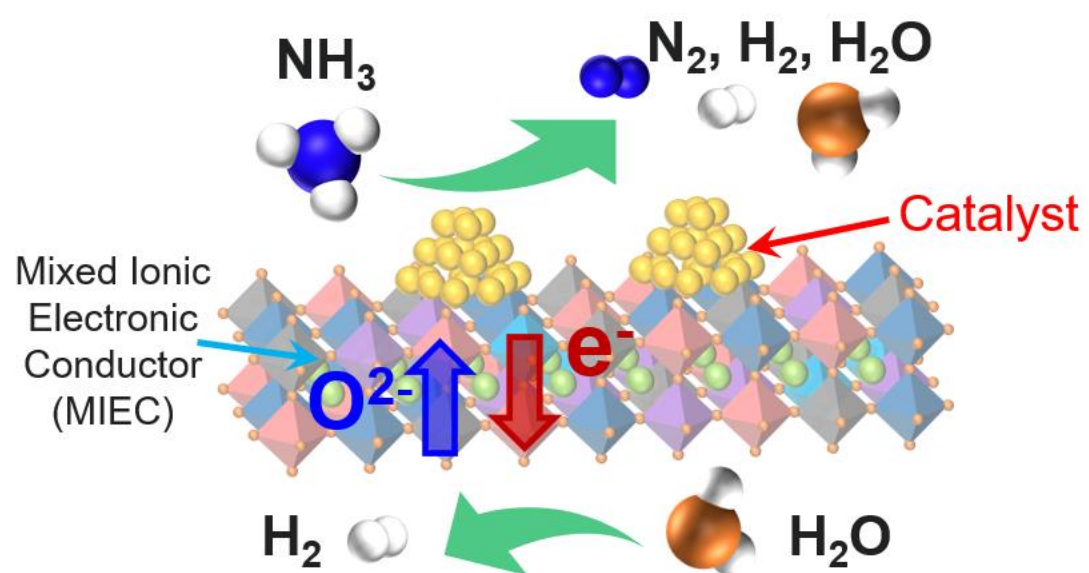
Mechanical and Aerospace Engineering & Earth Sciences
Chemical and Biomolecular Engineering (by courtesy)

09/09/2025



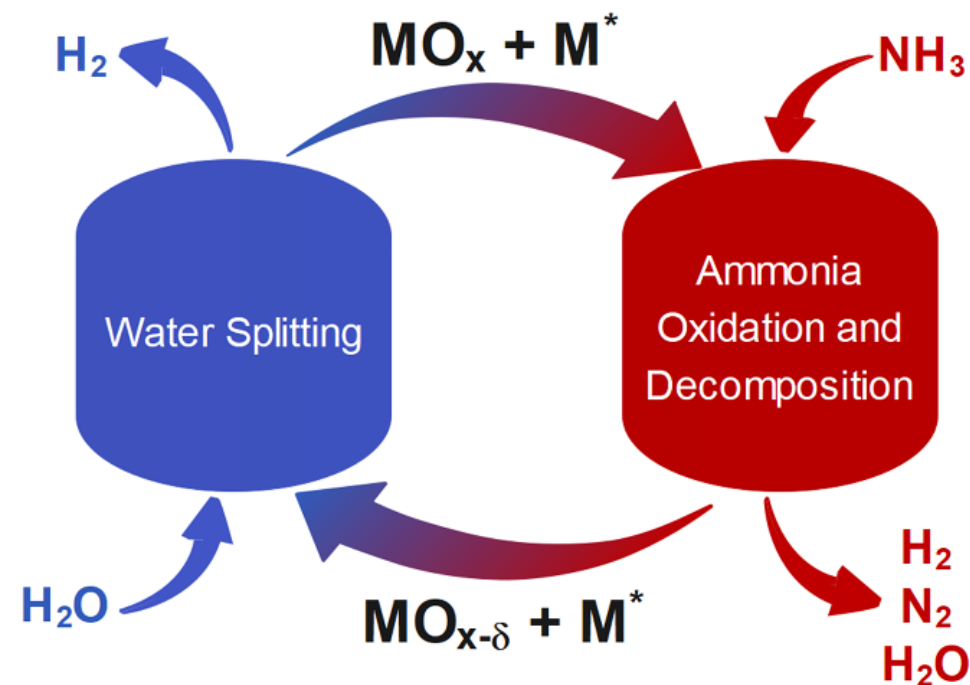


Oxygen permeation membrane



Ongoing research.

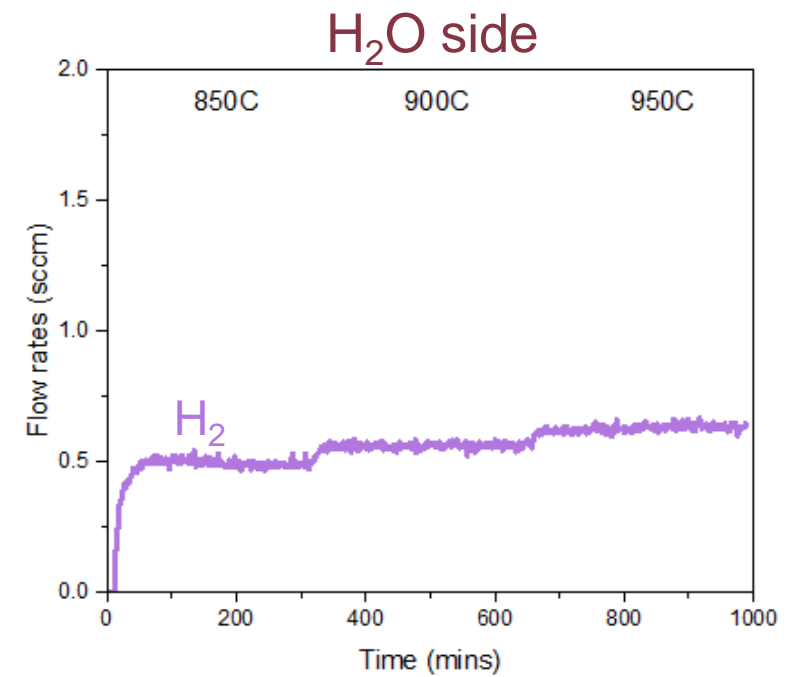
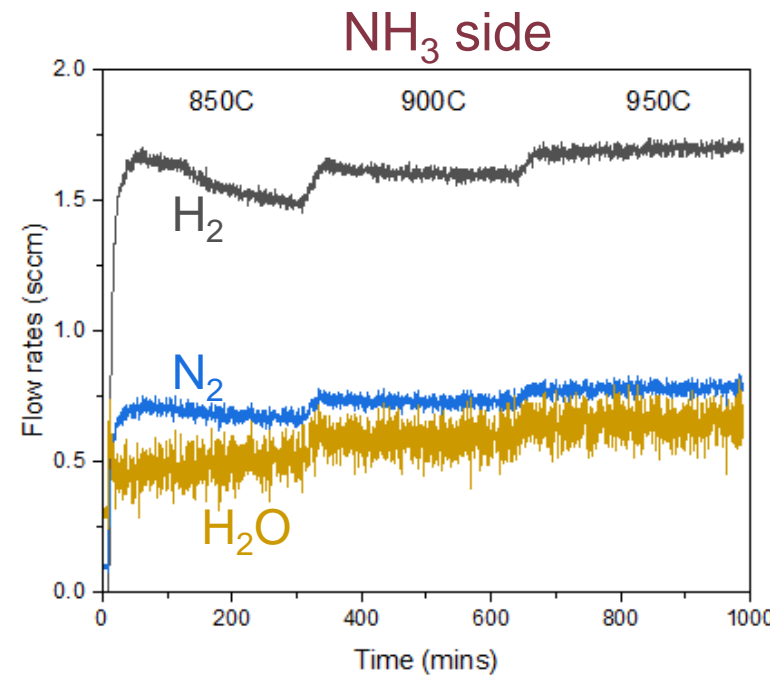
Chemical looping



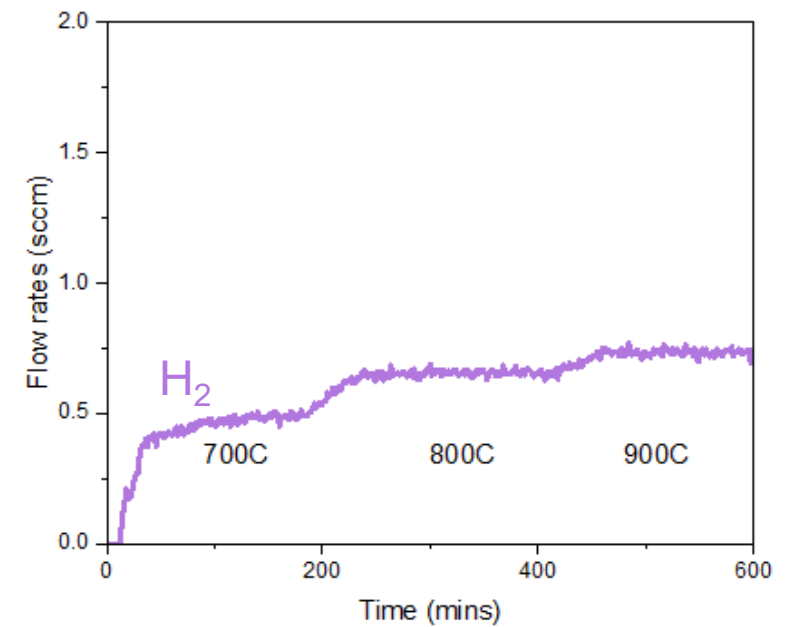
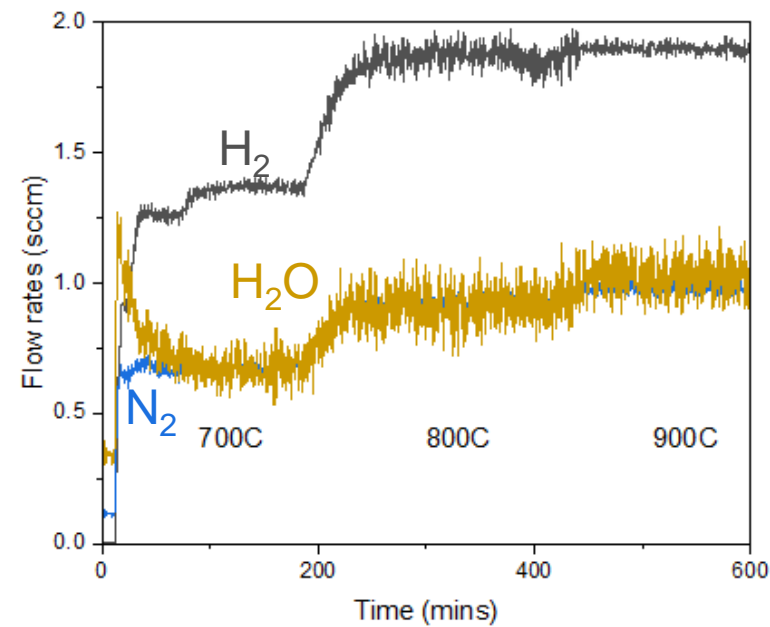
Arjomand, Shank, and Zhai*, *Green Chem.* (2025)

Oxygen Permeation Membrane NH₃ to H₂

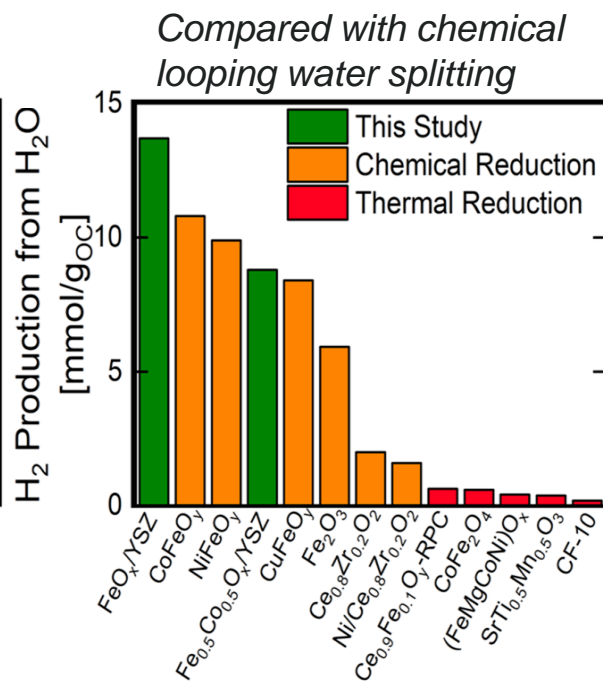
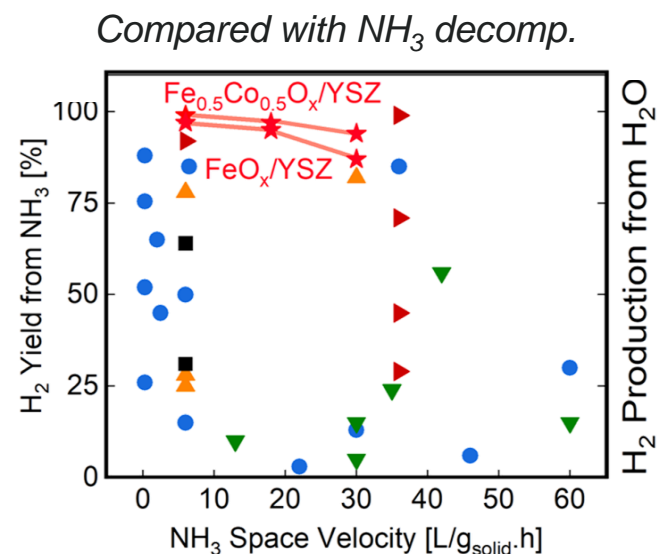
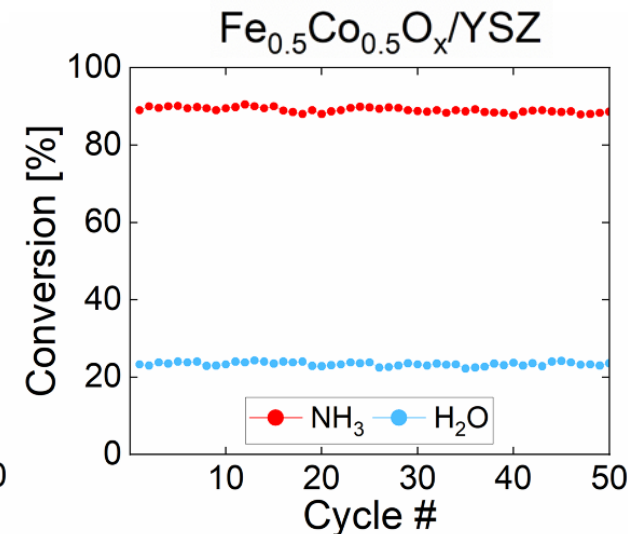
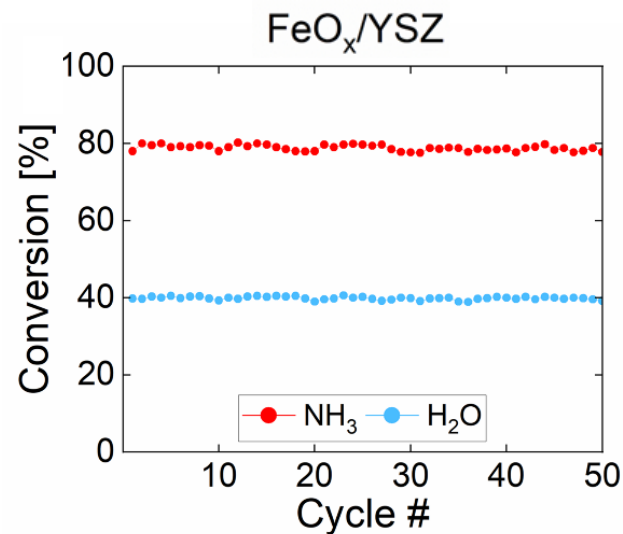
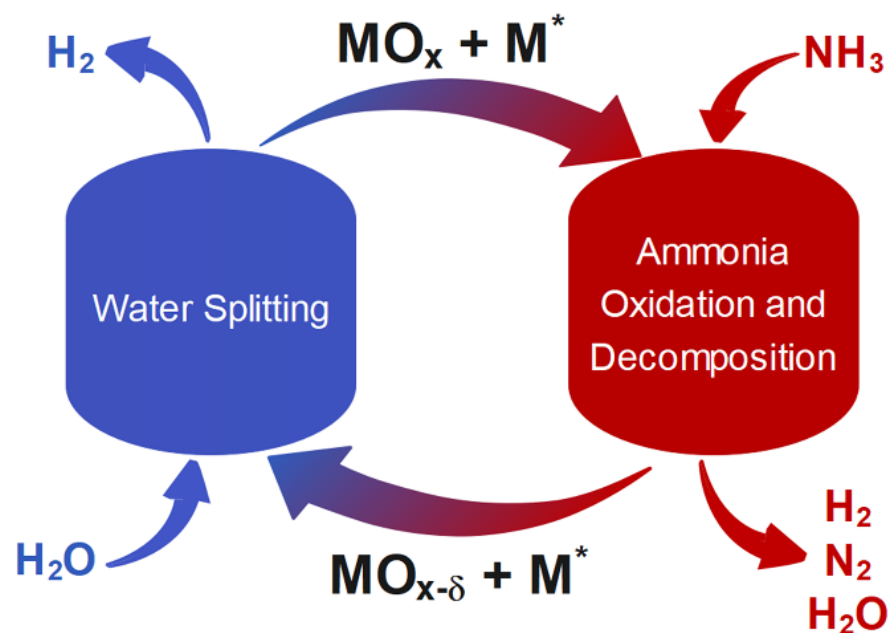
Two phase
 $\text{Ce}_{0.8}\text{Sm}_{0.2}\text{O}_{2-x}/$
 $\text{Sm}_{0.6}\text{Sr}_{0.4}\text{FeO}_{3-x}$



(LaSr)(CoFe)O_{3-x}

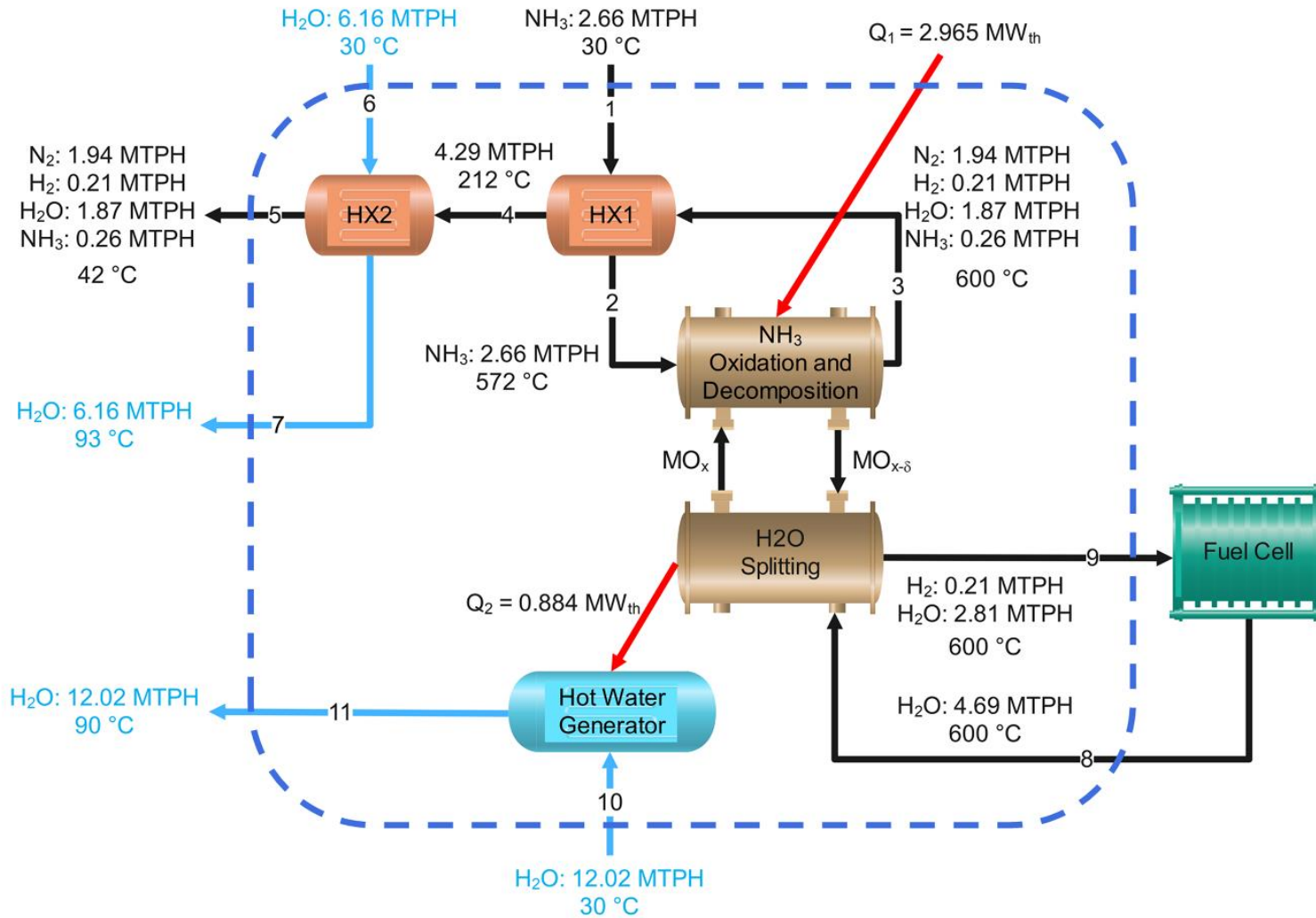


Chemical Looping NH_3 to H_2

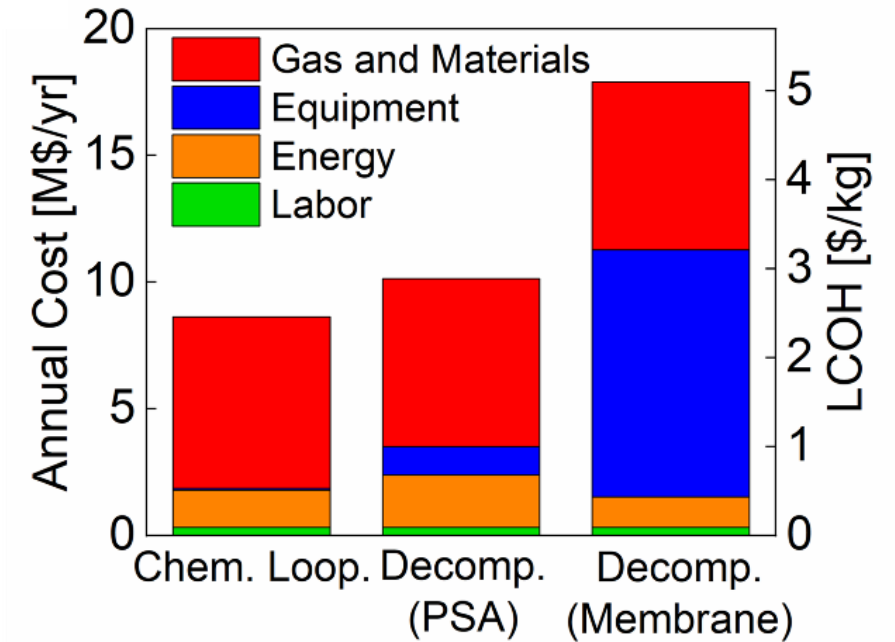


Arjomand, Shank, and Zhai*, *Green Chem.* (2025)

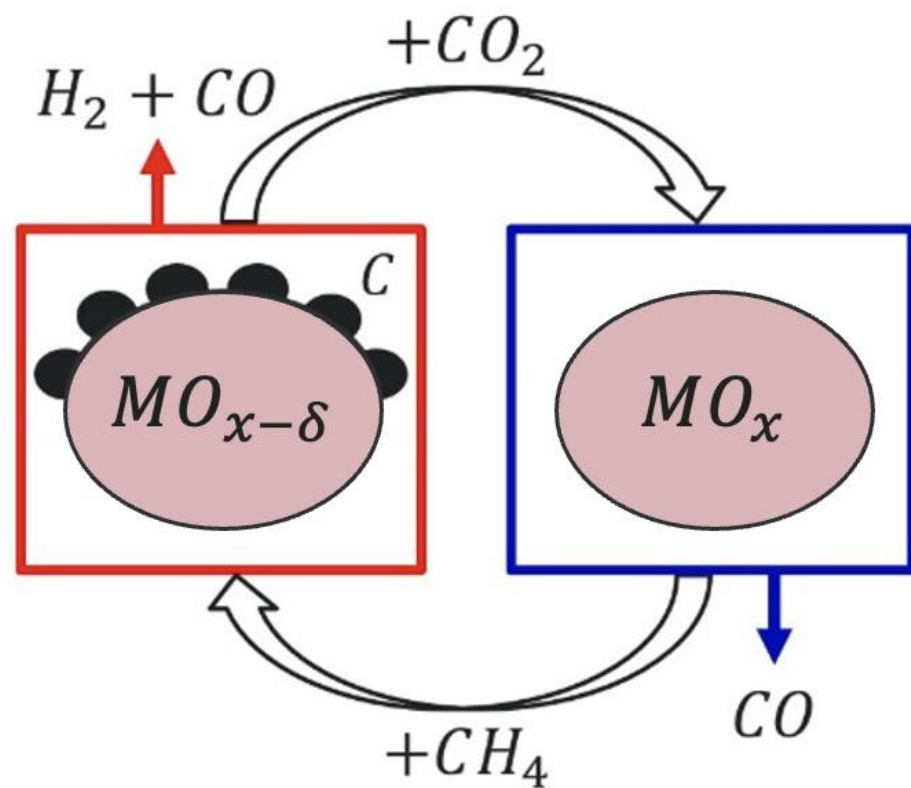
Energy and cost savings compared to direct NH_3 decomposition



MTPH: metric ton per hour



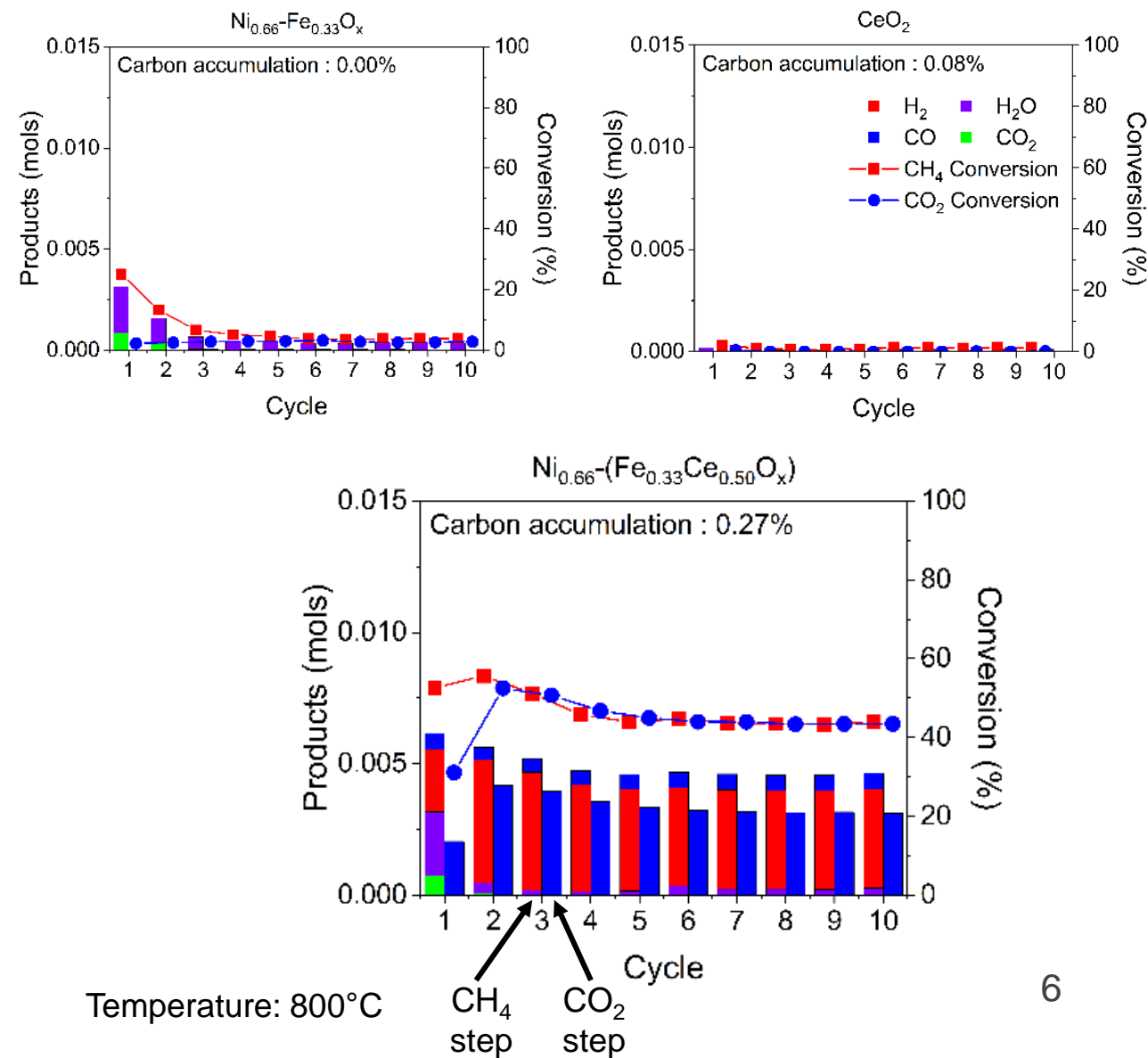
Synergy between phase transformation material and oxygen vacancy material



Kim, Tomechko, and Zhai*, *J. Mater. Chem. A* (2025)

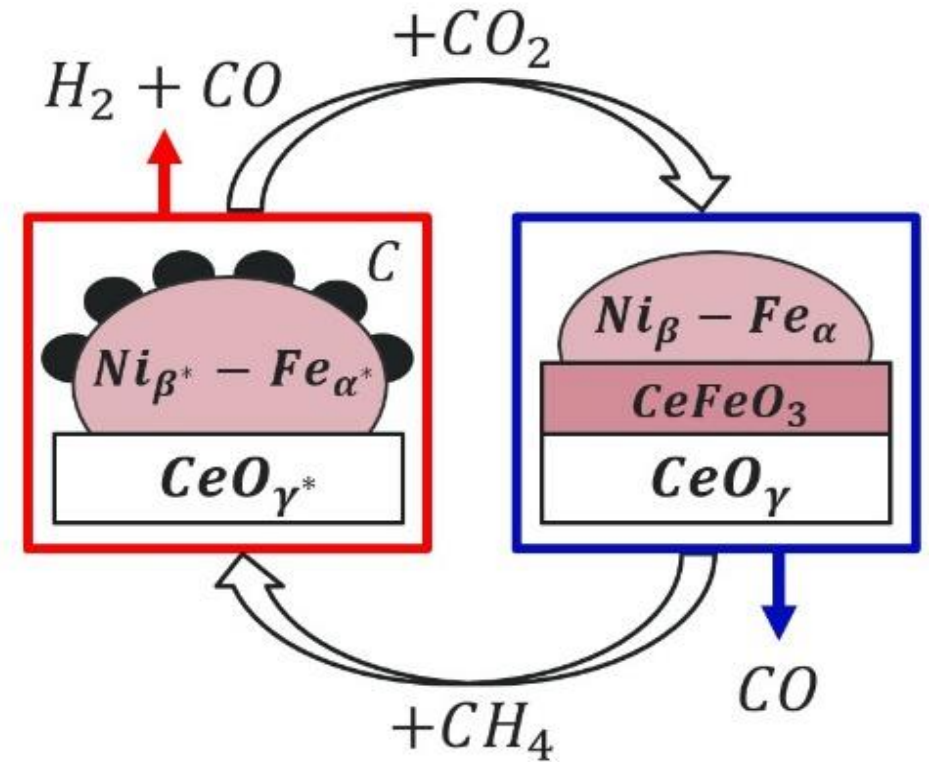
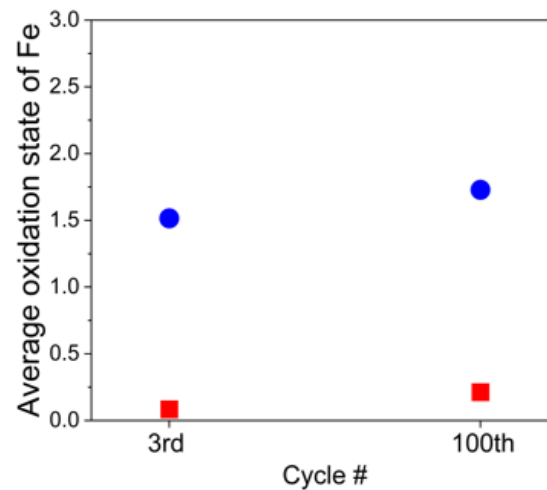
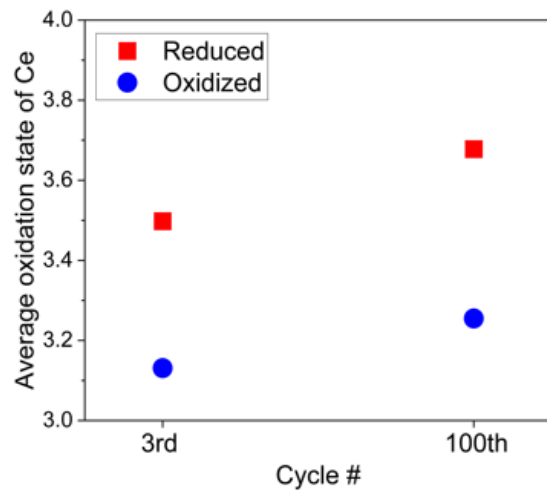
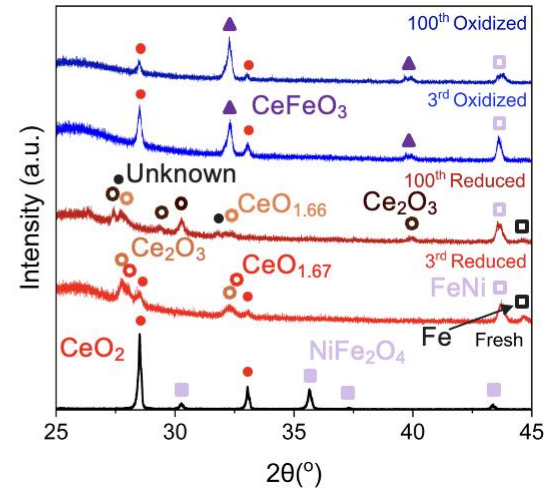
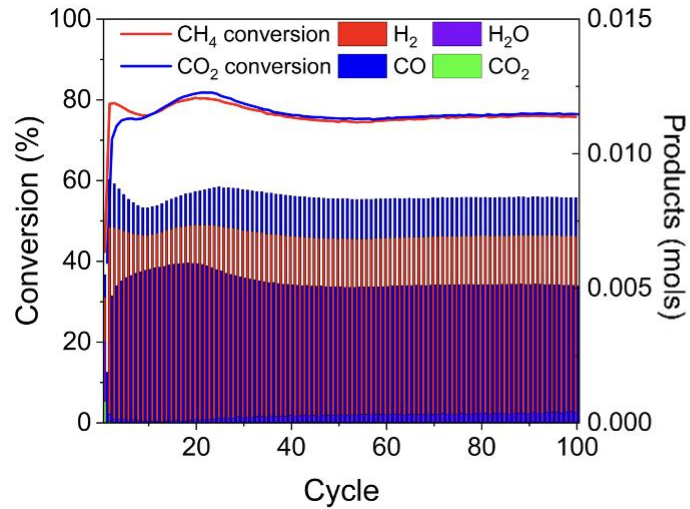


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$\text{Ni}_{0.34}-(\text{Fe}_{0.67}\text{Ce}_{0.50}\text{O}_x)$ for 100 cycles

Good cyclability and durability



Thank you for your attention!

Zhai Research Group u.osu.edu/zhai

Grad students



Minjung



Kyle



Taoran

Undergraduate researchers



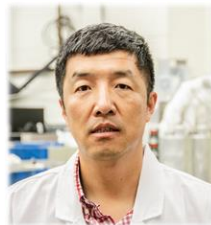
Yunming



Nicolo

Past group members contributing to the presented work: Dr. Jiangzhou Qin, Amir Arjomand, Michael Tomechko, Hefei Xu

Collaborators



Pr. Xingbo Liu
WVU



Pr. Wenyuan Li
WVU



Energy Efficiency &
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