



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

ORGANIZZATO DA



Bologna: un hub di ricerca per lo sviluppo
dell'idrogeno - 9 ottobre 2024

Integrating Nanostructured Materials with Electrochemical Devices for Enhanced CO₂ Conversion

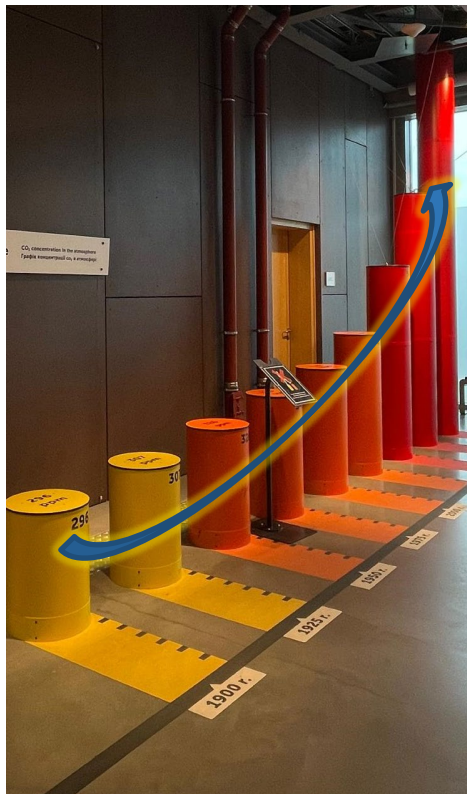
Alessia Pollice

Electrochemistry of **M**olecular and
Functional **M**aterials (**EMFM**) Group.
Dipartimento di Chimica «Giacomo Ciamician»
Alma Mater Studiorum – Università di Bologna

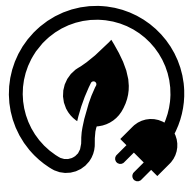
BolognaFiere 9-11 ottobre

CO₂ Concentration in the Atmosphere

**CENTRIUM
NAUKI
KOPERNIK**



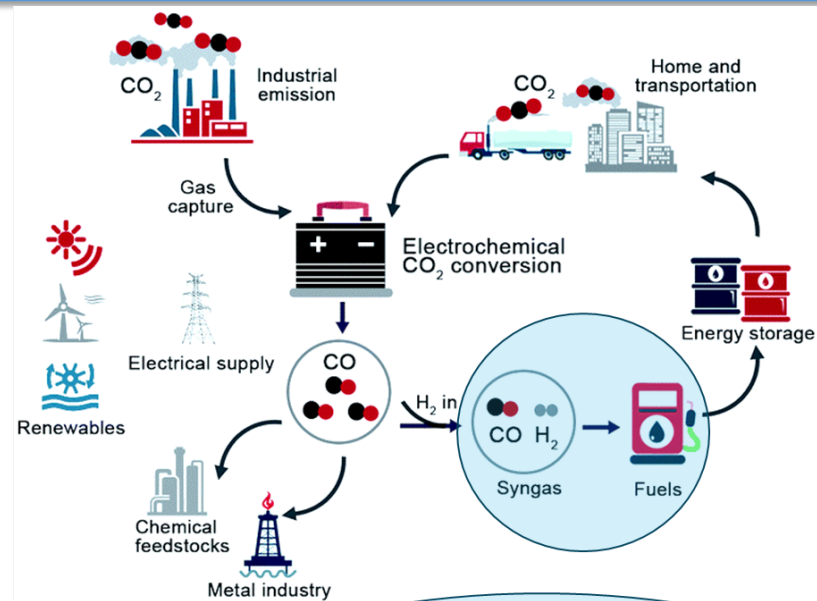
Artificial Carbon Cycle



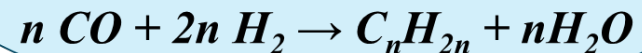
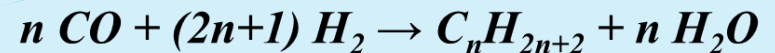
Energy
Vectors



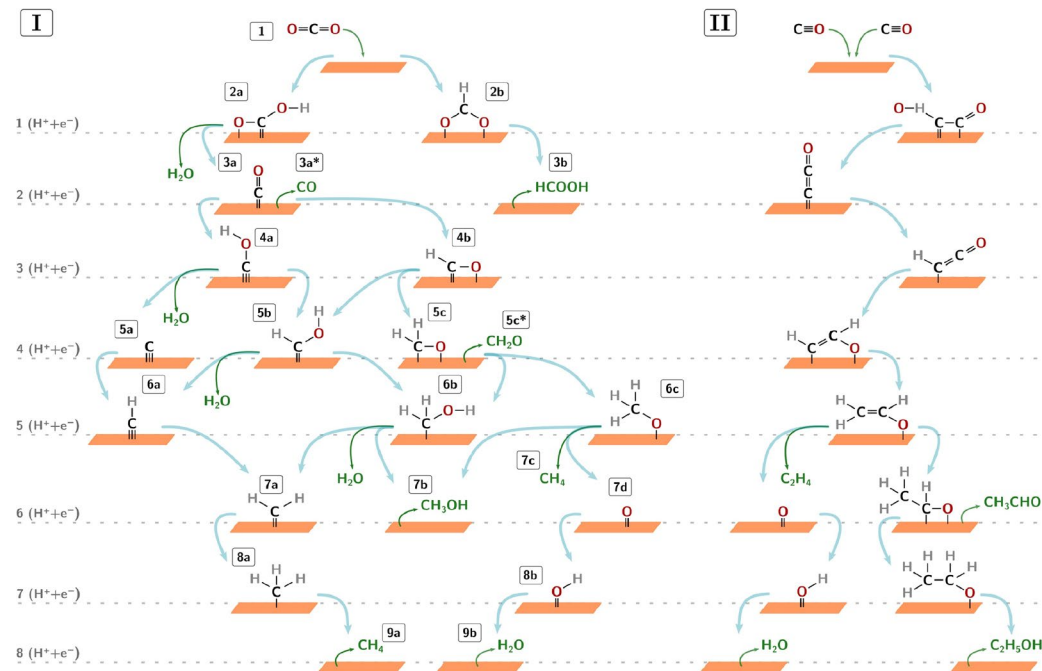
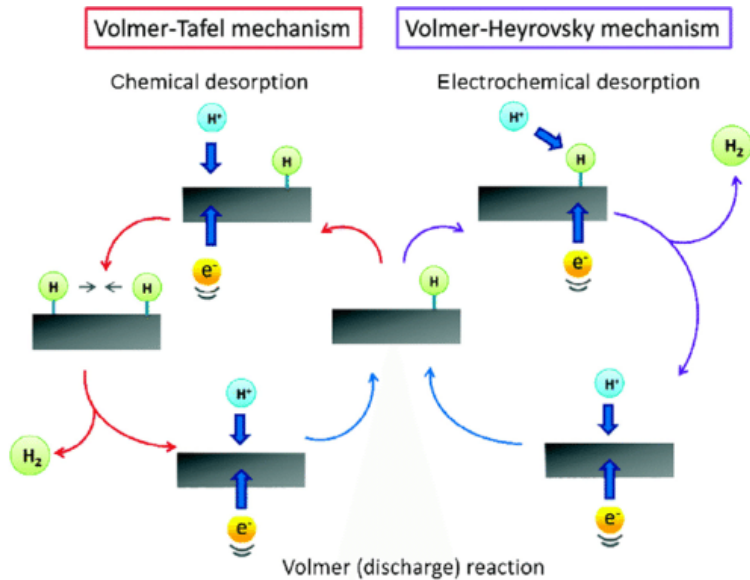
Value Added
Molecules



Tropsch – Fisher Process:

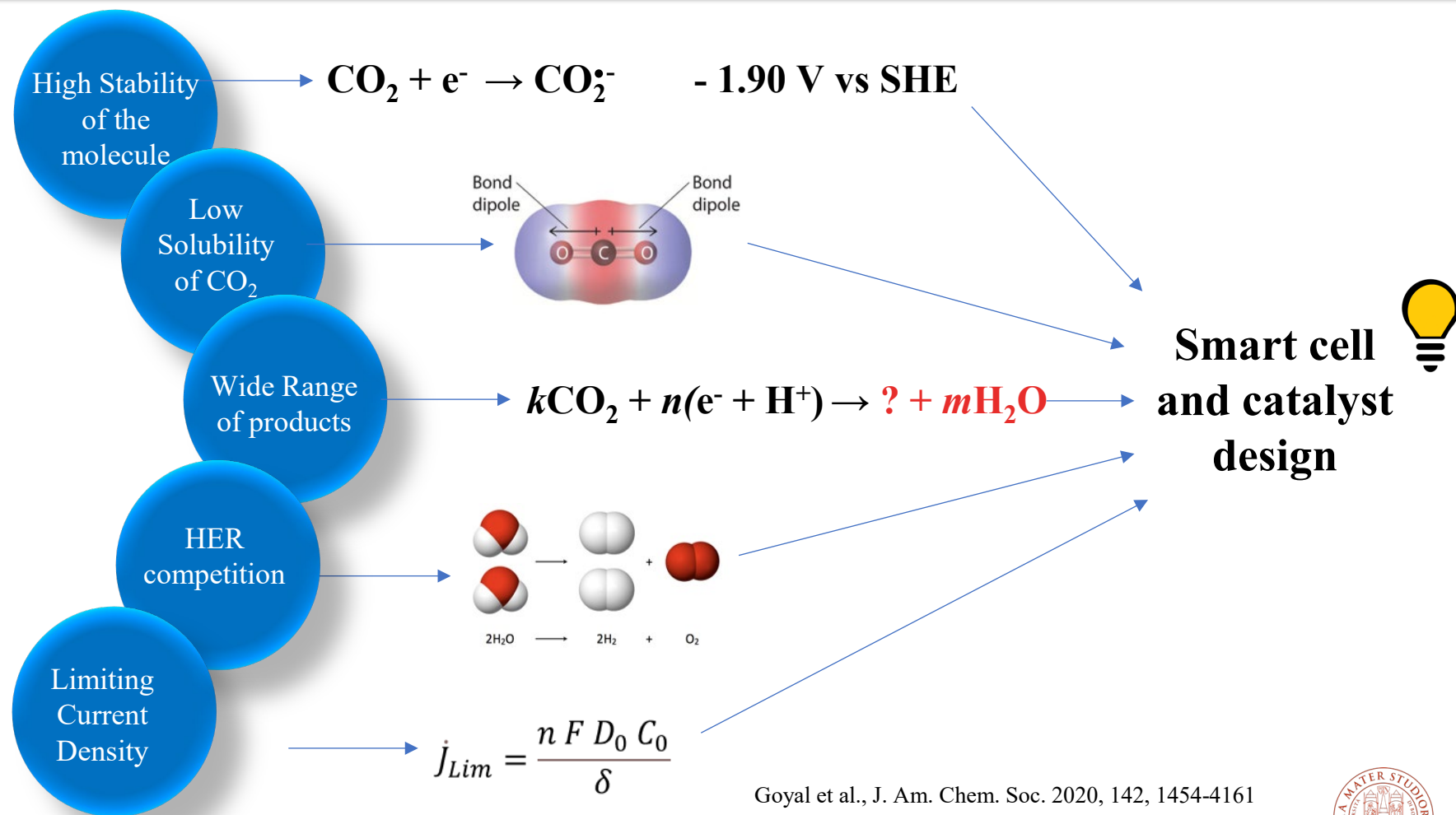


CO₂RR: The Challenge



Xing et al., Beyond Catalytic materials: Controlling local gas/liquid enviroment in the catalyst layer for CO₂ electrolysis, Journal of Energy Chemistry, Vol. 66, March 22, Pages 45-51

CO₂RR: The Problems

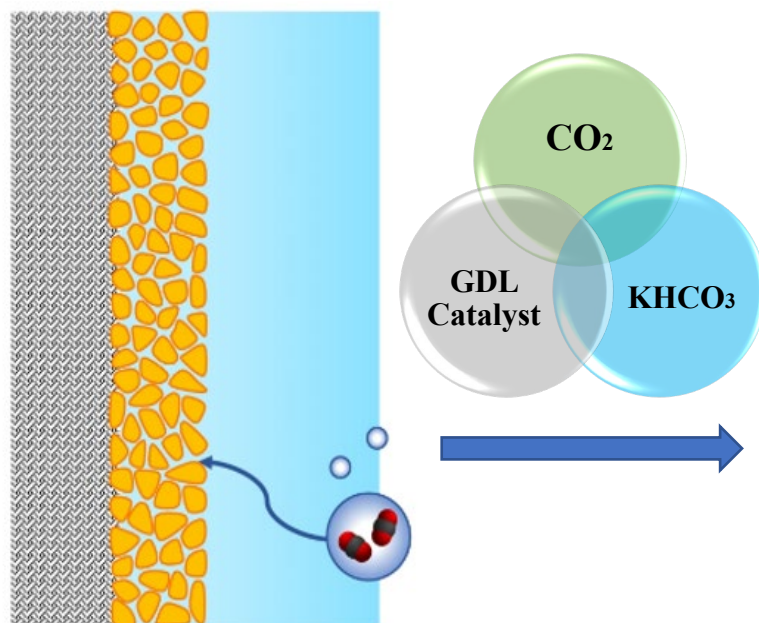


Goyal et al., J. Am. Chem. Soc. 2020, 142, 1454-4161

CO₂RR Smart Design: The GDE System

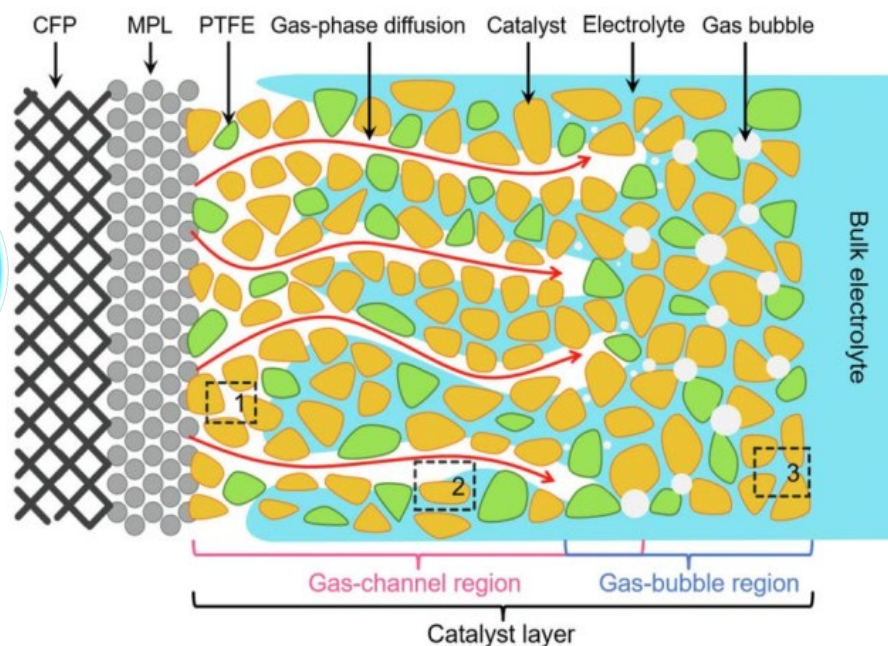
BIPHASIC SYSTEM:

- Very high Diffusion Layer



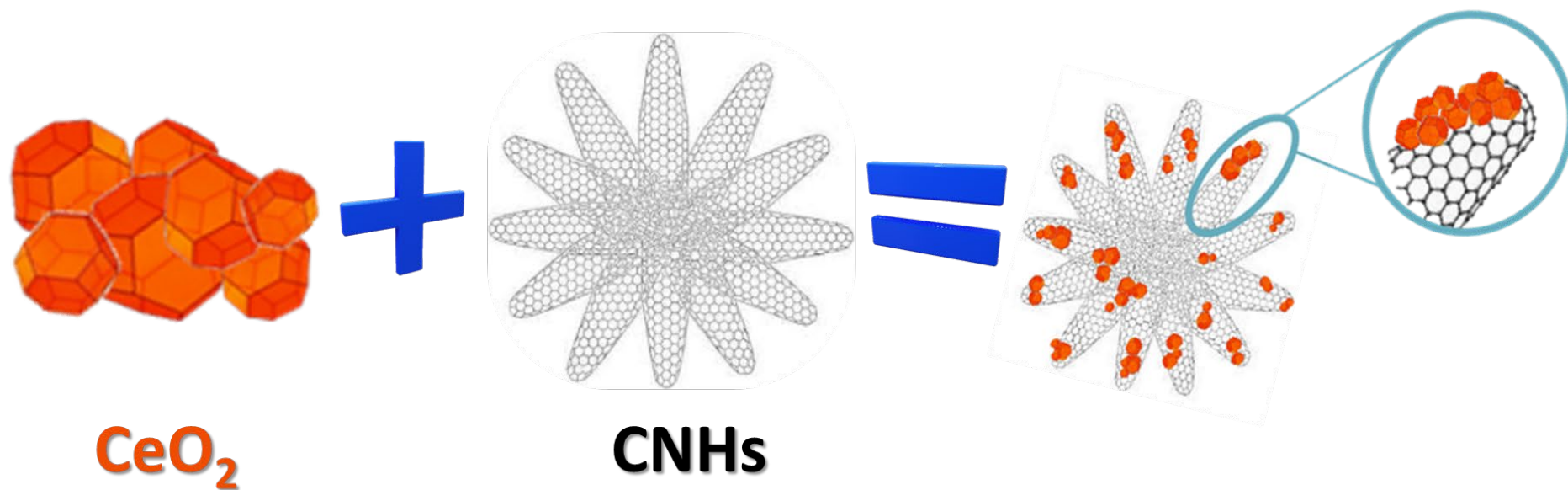
THREEPHASIC SYSTEM:

- Diffusion layer significantly reduced.
- Balanced gas-liquid-solid phase ratio.



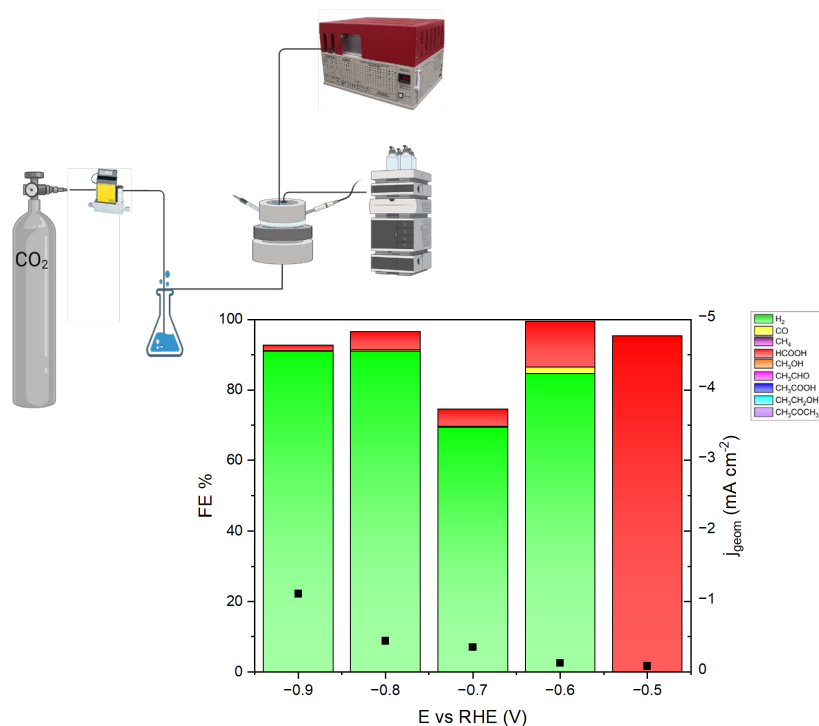
Xing et al., Beyond Catalytic materials: Controlling local gas/liquid environment in the catalyst layer for CO₂ electrolysis, Journal of Energy Chemistry, Vol. 66, March 22, Pages 45-51

CO₂RR Smart Design: The Catalyst

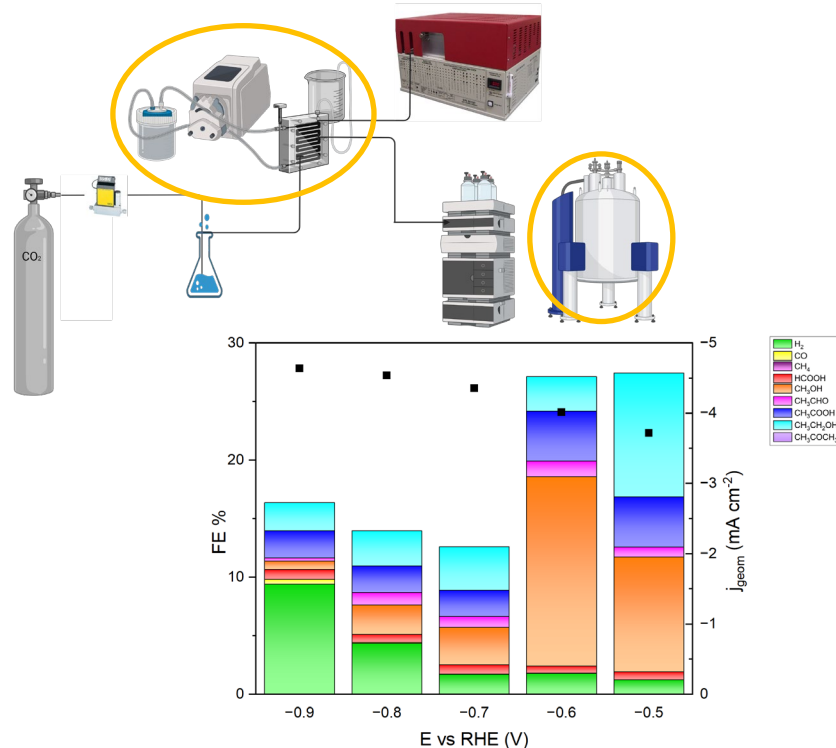


CO₂RR: The Results

Static System



Flow System



CO₂RR: Conclusions



CeO₂@CNH great catalyst
when coupled with a **GDE**
system.



H₂ and Formate in the **Static**
system.



The **Flow Cell Set-Up**
guarantees **current densities**
ten times **higher**.



Alcohols and Acetate in the
Flow System.

Thank You!



EMFM Team:
Prof. F. Paolucci
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Dott.ssa C. Mariani
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Dott. G. Giagu





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Credits:

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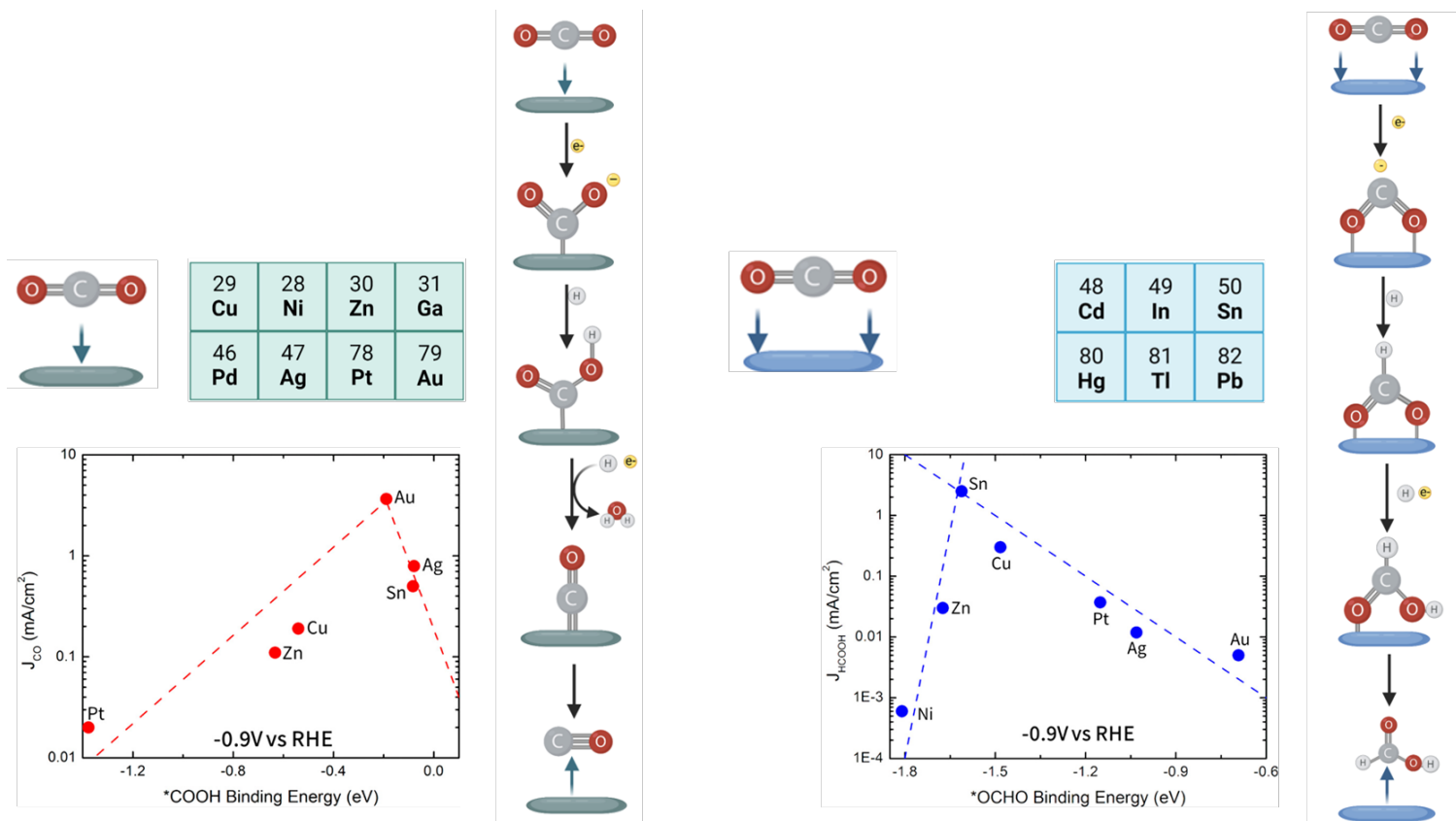
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CO₂RR: The Intermediates



Li, Q. et al. Tuning Sn-Catalysis for Electrochemical Reduction of CO₂ to CO via the Core/Shell Cu/SnO₂ Structure. *Journal of the American Chemical Society* (2017).