Synthesis and screening of MOF-based nanomaterials for the CO_2 electroreduction to methanol

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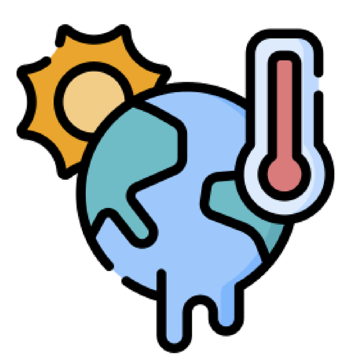
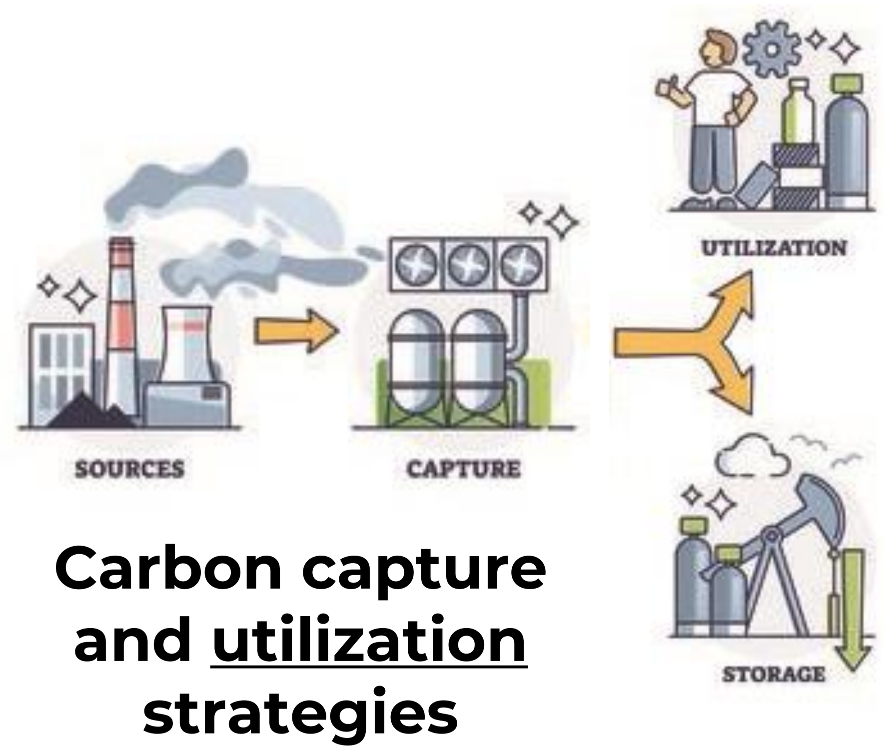
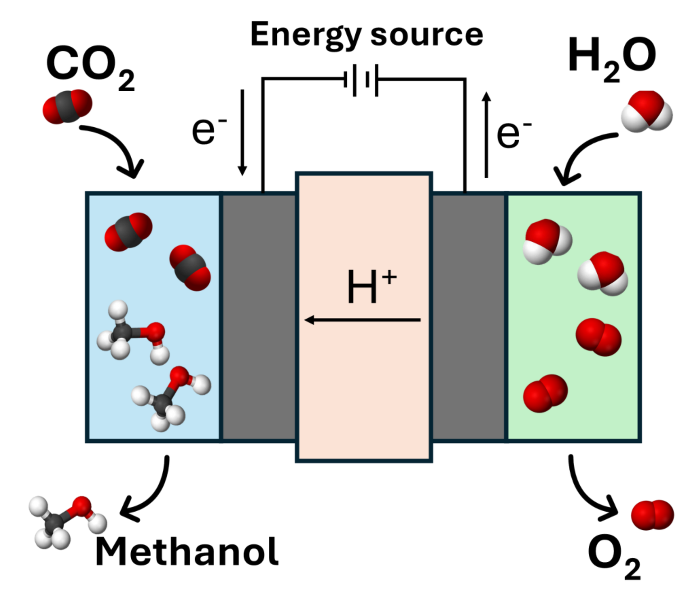
INTRODUCTION



[CO_2]: 421 ppm

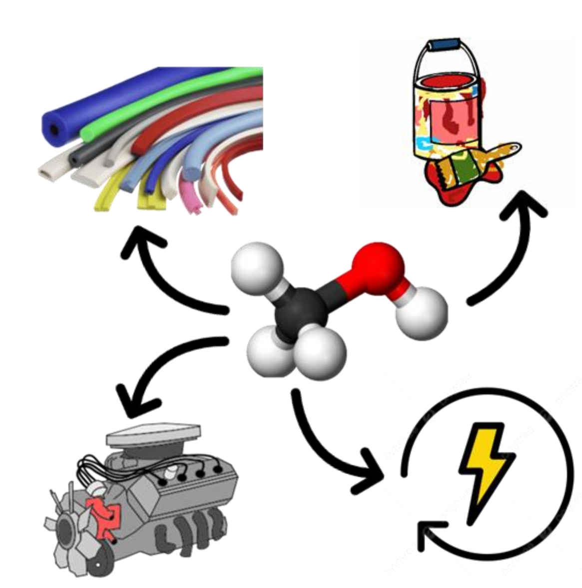


Carbon capture and utilization strategies



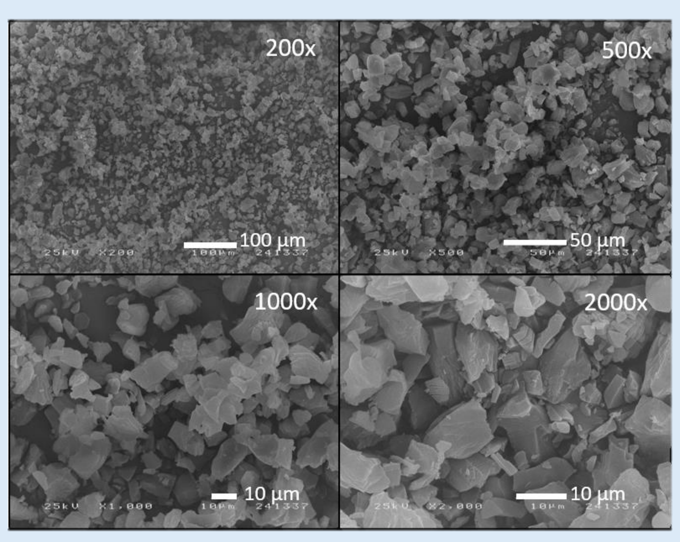
Electrochemical reduction of CO_2 [1]

Methanol [2]

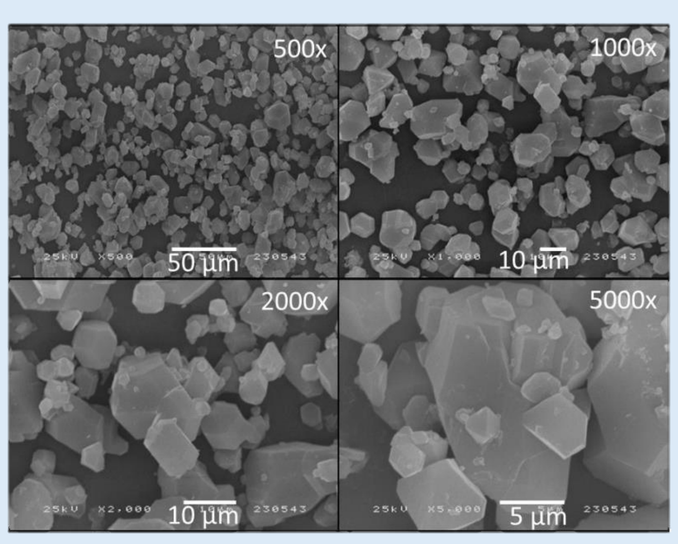


METHODOLOGY

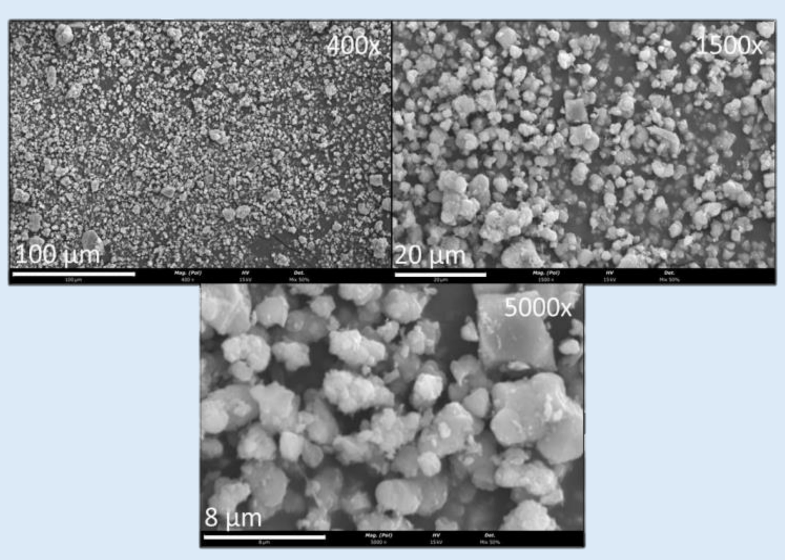
Cu-BTC MOF



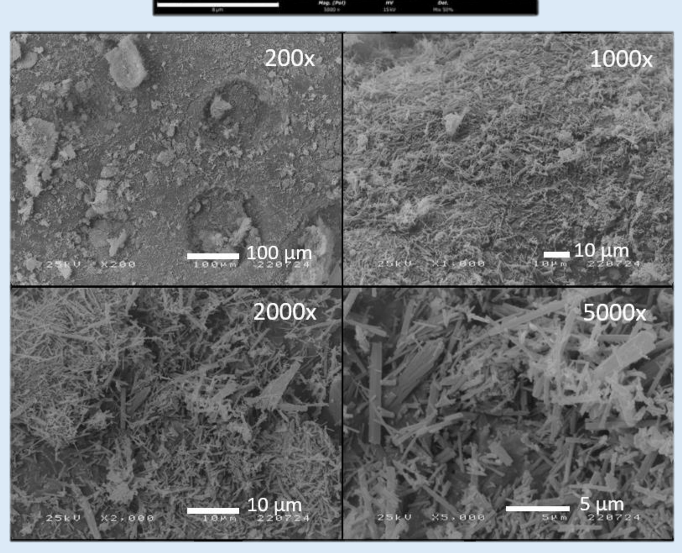
Mg-MOF-74



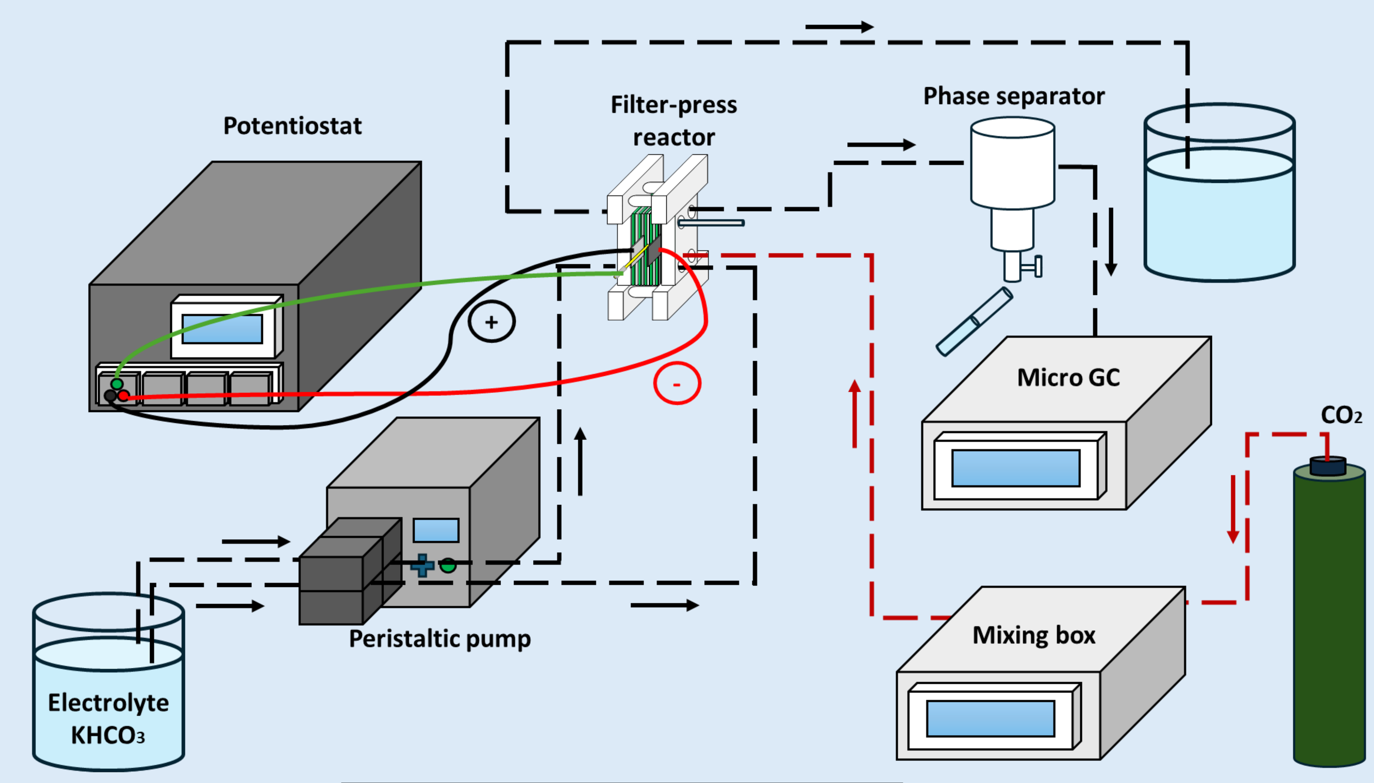
Ni-MOF-74



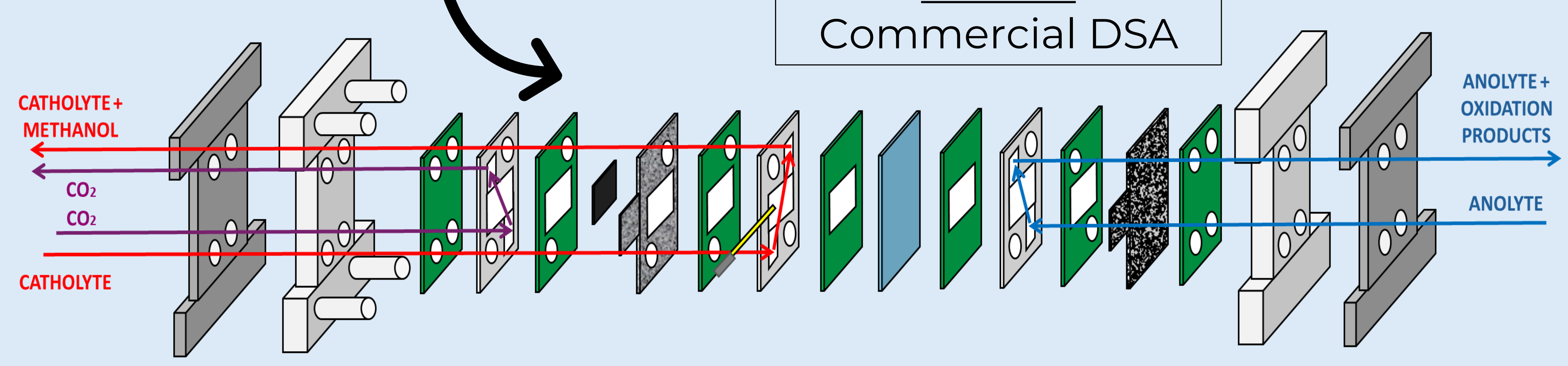
Cu-MOF-74



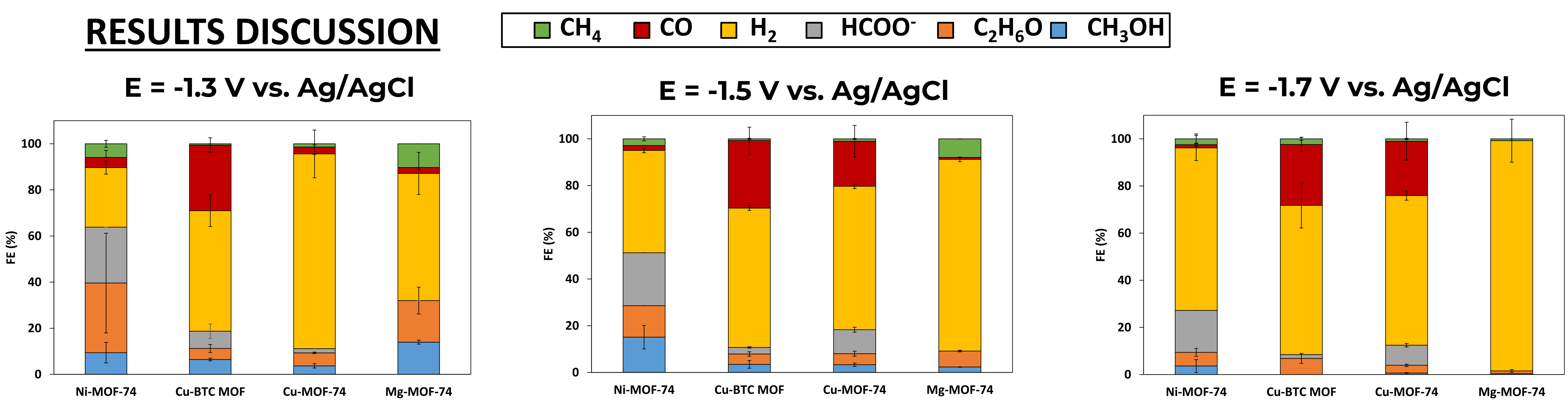
Cathode:
Catalyst load: 1 $mg \cdot cm^{-2}$
MOF-based catalyst (GDE) [3]



Anode:
Commercial DSA



RESULTS DISCUSSION



Best results towards C_2H_6O obtention: Ni-MOF-74
FE = 31.12%
EC = $5.14 \cdot 10^3$ $kWh \cdot kmol^{-1}$

Best results towards CH_3OH obtention: Ni-MOF-74
FE = 15.31%
EC = $3.99 \cdot 10^3$ $kWh \cdot kmol^{-1}$

The less promising results
Higher cathodic potentials imply a great HER developement

CONCLUSIONS AND FUTURE PERSPECTIVES

Four MOF-based materials were tried out. All of them using 0.5M $KHCO_3$ as electrolyte, for 1 $mg \cdot cm^{-2}$, at different fixed cathodic potentials: -1.3, -1.5 and-1.7 V vs. Ag/AgCl.

Given these results, future steps should include assessing C_2H_6O as another target product due to its concurrent formation with CH_3OH, exploring different cathodic catalyst loadings and evaluating ways of diminishing those high EC values.

REFERENCES

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