Maximizing Catalyst Use in CO_2 Electroreduction:

A MOF-mediated Approach

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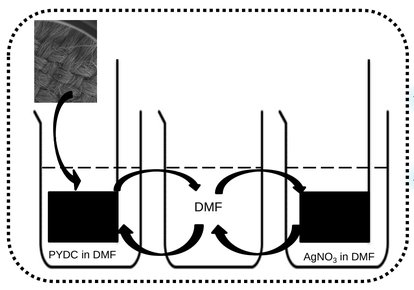
Catalysis Engineering

Synthesis



Layer-by-Layer growth

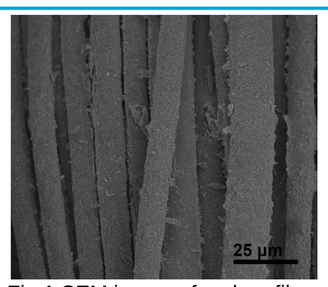
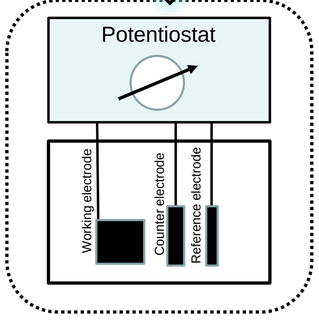


Fig.1 SEM image of carbon fiber supported AgMOF



Electro-reduction of AgMOF

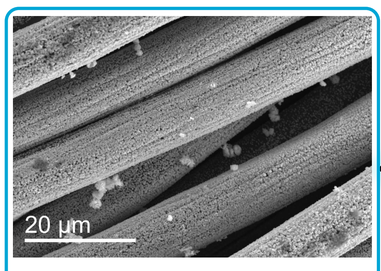


Fig.2 SEM image of electro-reduced carbon fiber supported Ag

Characterization

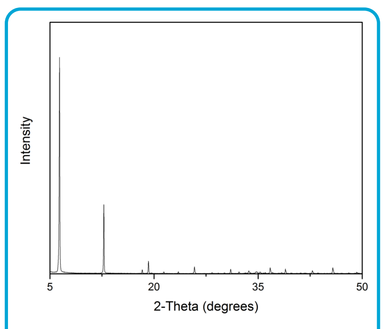


Fig.3 XRD pattern of Ag MOF

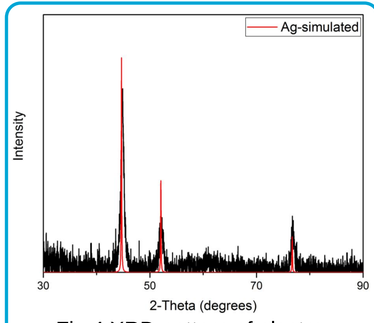


Fig.4 XRD pattern of electro-reduced Ag catalyst

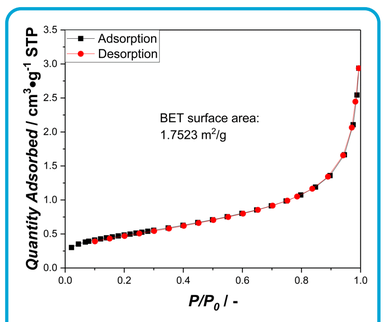


Fig.5 N_2-Isotherm of Ag MOF

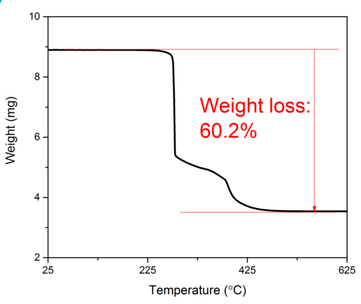
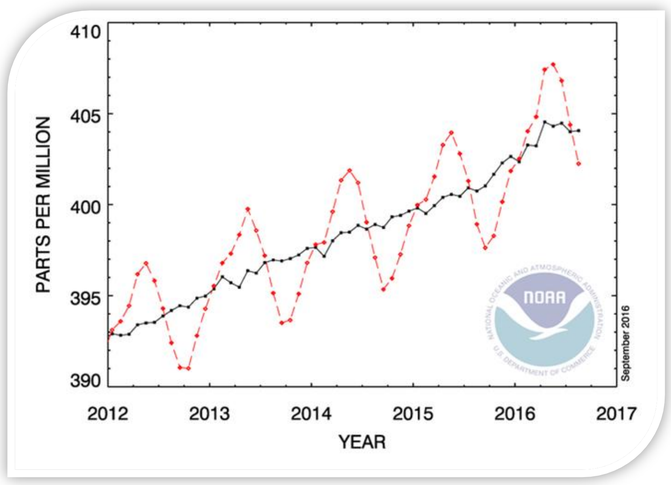
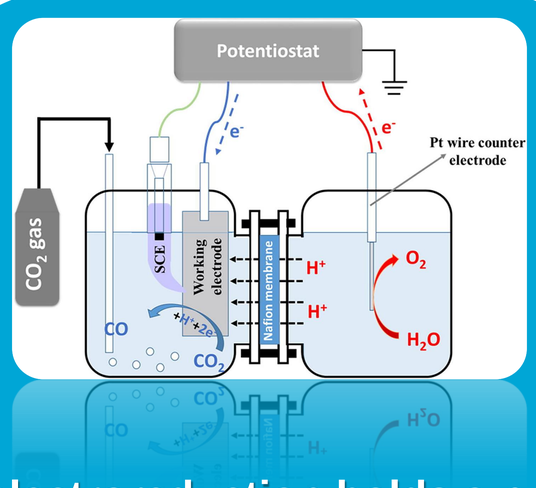


Fig.6 TGA curve of Ag MOF

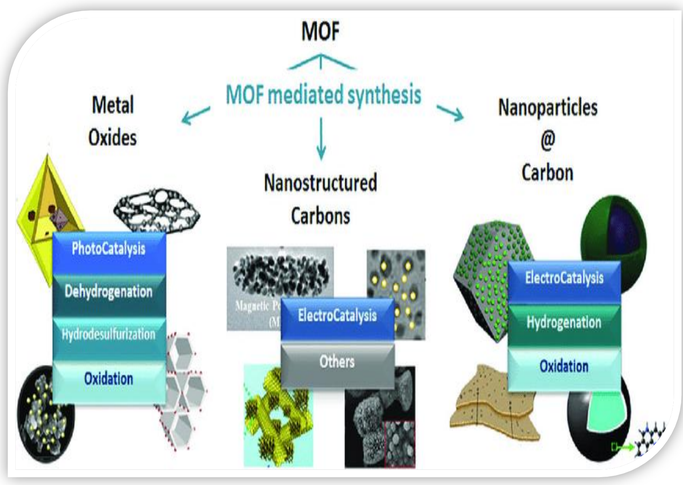
- AgMOF is highly crystalline
- Electro-reduction of AgMOF produces metallic Ag
- AgMOF is non-porous
- Weight ratio of Ag in AgMOF: ~40%



Setting CO_2 Scene

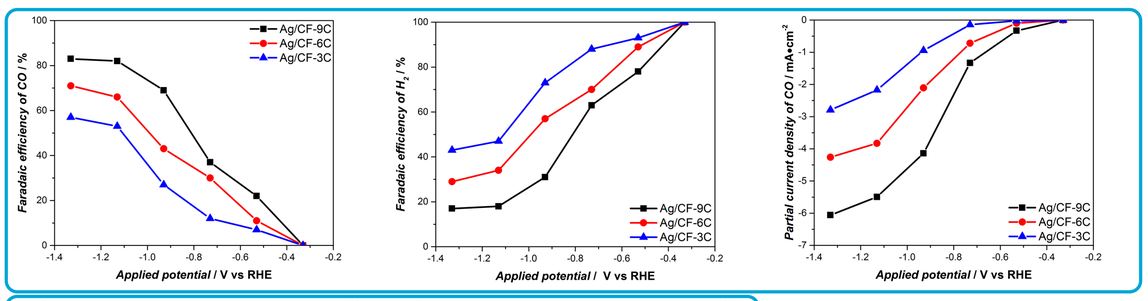


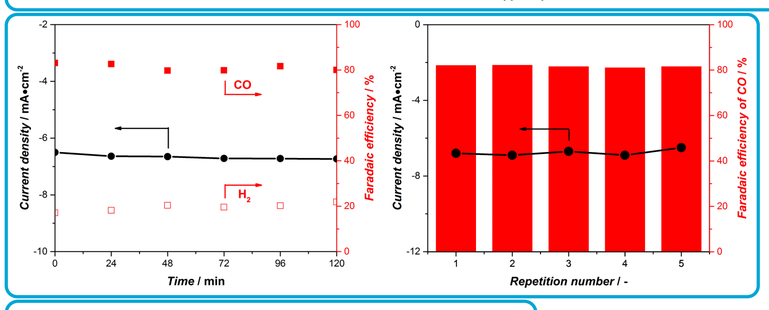
- ✓ CO_2 electroreduction holds a promising future in utilizing CO_2.
- × To process 1 ton of CO_2 per hour, 8 tons of Ag are needed.



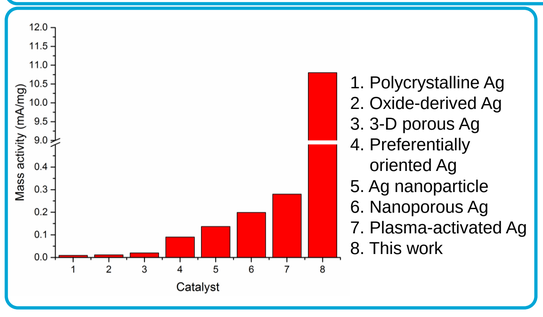
MOF-mediated synthesis

Performance





- CO and H_2 are the only products
- Faradaic efficiency for CO as high as ~83%



1. Polycrystalline Ag
2. Oxide-derived Ag
3. 3-D porous Ag
4. Preferentially oriented Ag
5. Ag nanoparticle
6. Nanoporous Ag
7. Plasma-activated Ag
8. This work

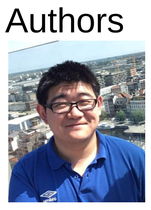
- Excellent stability for at least 2h and 5 recycles
- Mass activity is ~3 order of magnitude higher than polycrystalline Ag

Conclusion and Outlook

- ✓ Ag catalyst prepared by electro-decomposition of a AgMOF
- ✓ The catalyst can selectively reduce CO_2 to CO with FE of CO as high as ~83%
- ✓ Very good catalyst stability for 2h, along with excellent recycling stability
- ✓ Outstanding mass activity, ~3 order of magnitude higher than polycrystalline Ag

- ❑ Direct preparation of electrode for CO2ER with MOF-mediated synthesis
- ❑ Electro-reduction of MOFs as a new controllable synthesis method

Authors



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Challenge the future