IDF INNOV

From invention to innovation

VALORIZATION OF CO2 VIA A NEW KIND OF CATALYSTS

New iron porphyrin-based catalysts could turn CO2 from waste to resource and become a pillar of the Carbon Capture & Utilization (CCU) industry.

CO2 valorization ▪ CO2 electroreduction ▪ Low cost catalyst ▪ Iron porphyrin ▪ Carbon monoxide ▪ Synthetic fuels ▪ Syngas ▪ Electrofuels ▪ Energy conversion and storage

APPLICATIONS

- Chemical industry: synthesis of CO and syngas used for the production of methanol or synthetic fuels
- CO2 capture and utilization (CCU)
- Valorization of intermittent sources of electricity (energy conversion and storage)

DEVELOPMENT PHASE

A lab-scale electrolyzer to selectively convert CO2 to CO is currently in design phase

PUBLICATIONS

C. Costentin, S. Drouet, M. Robert, and J. M. Saveant. A local proton source enhances CO2 electroreduction to CO by a molecular fe catalyst. Science, 338(6103):90–4, 2012.

C. Costentin, M. Robert, and J. M. Saveant. Catalysis of the electro- chemical reduction of carbon dioxide. Chem Soc Rev, 42(6):2423–36, 2013.

C. Costentin, M. Robert, J.-M. Savéant, A. Tatin, Efficient and selective molecular catalyst for the CO2-to-CO electrochemical conversion in water. Proc Natl Acad Sci USA, 2015 ; 112(22):6882-6.

INTELLECTUAL PROPERTY

US, CA, AU patent applications: US2015096899

International patent application: WO2015169763.

Priority patent application filed on Feb., 2015

CONTACT

Mail : bd-3S@idfinnov.com

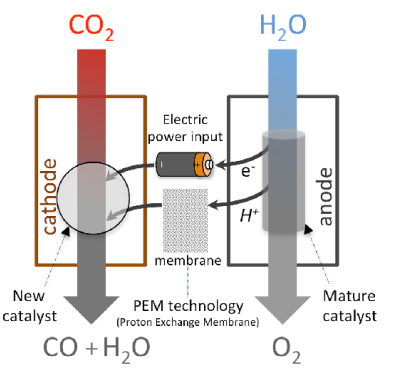
Phone : +33(0)1.80.06.80.03

PRESENTATION

CO2 is a highly stable molecule that needs a lot of energy in order to be transformed and react with other molecules. Hence, CO2 utilization by the industry has remained limited. However, one could see CO2 as a source of carbon and use this material to store energy by breaking C-O bonds and making energy-rich C-H bonds instead.

Over the past 20 years, thousands of scientific articles about CO2 catalyzed reduction have been published but the reported catalysts are either based on rare materials (such as Pd, Re, Ru) or show poor performances.

In contrast, our PEM technology based on iron porphyrin catalysts is very promising since it does not rely on rare materials and has proved excellent performances to turn CO2 into CO at ambient temperatures both in organic and neutral pH aqueous solutions. Electrogenerated CO could be further processed with green hydrogen for synthetic fuel production.



COMPETITIVE ADVANTAGES

- Cheap catalyst (Fe) vs. actual ones (Ru, Rh, Pd, Re, Pt…)
- Ambient temperature / Atmospheric pressure
- Compatible with organic and aqueous solvents (pH 7)
- High catalytic efficiency (>90% selectivity, low overpotential)
- Heterogeneous catalysis
- Catalytic film materials do not require any special care