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## Are FeTSPP based-hybrids layered materials efficient for electrochemical activation of CO<sub>2</sub>?

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Homogenous electro-catalyst such as iron (III) tetra-phenyl porphyrins (FeTPP) showed an efficient transformation of CO<sub>2</sub>-to-CO in organic and aqueous media<sup>[1]</sup>. To improve the catalytic durability and enhance the catalytic efficiency, heterogeneous electro-catalysts were prepared by the intercalation of (4-sulfonatophenyl)-porphyrin-Fe(III) chloride (FeTSPP) in layered double hydroxides (LDH)<sup>[2]</sup> and layered simple hydroxides (LSH)<sup>[3]</sup>. The structural and morphological characteristics of ZnCr-FeTSPP LDH and Zn-FeTSPP LSH were compared. Then, the electroactivity of immobilized FeTSPP was tested in different electrolytes under inert atmosphere Ar or in the presence of CO<sub>2</sub>. Based on these results, a preparative scale electrolysis was performed to determine the selectivity and the faradic efficiency of the transformation of CO<sub>2</sub> to CO. Preliminary results indicated that electrolysis performed in presence of immobilized Fe porphyrin do not lead as expected to CO formation but selectively to H<sub>2</sub> production. Assumptions about these results will be discussed.

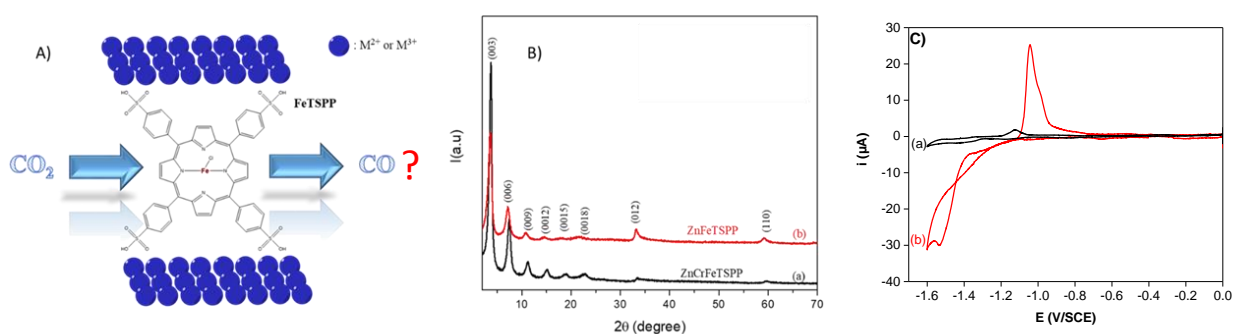


Figure 1: A) Schematic presentation of FeTSPP based layered hybrid materials B) X-ray diffractograms of ZnCr-FeTSPP (a) and Zn-FeTSPP (b), C) Cyclic voltammograms of ZnCr-FeTSPP/GCE a) Ar pH 8.6, b) CO<sub>2</sub> pH 4.5 ( $v = 50 \text{ mV s}^{-1}$ ).

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### References

- [1] C Costentin, M. Robert, J.M. Savéant, A. Tatin, *PNAS* 112 (2015) 6882-6886.
- [2] C. Taviot-Guého, M. Halma, K. Charradi, C. Forano, C., Mousty, *New J. Chem.* 35 (2011) 1898–1905
- [2] J. Demel, P. Kuba, I. Jirka, P. Kovar, M. Pospisil, K. Lang, *J. Phys. Chem. C* 114 (2010) 16321–16328