Mo-based catalysts for CO_2 (electro)reduction

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Though CO_2 is a potential carbon source, it has found only a few direct applications so far, and is best known as an environmentally harmful waste ("greenhouse gas"). Its industrial use often implies a preliminary reduction into products of higher added value like CO, formic acid or, preferentially, methanol.[1] Unfortunately, with carbon in its highest oxidation state, CO_2 is a highly stable molecule (C=O bond: 803 $kJ.mol^{-1}$) and its successive reductions require a catalyst for both activation and selectivity. So far, Cu-based catalysts have remained the most popular ones due to their ability to allow CO_2 reduction up to methane, but their good activity is usually at the expense of a low selectivity.

Contrariwise, molybdenum is a relatively abundant and non-toxic element of which the CO_2 reduction properties have received little attention. However, two recent results have been hinting to its potential as a catalyst: commercial MoO_2 microparticles have been shown to present electrocatalytic CO_2 reduction abilities, especially in the presence of an ionic liquid as co-catalyst,[2] and some mixed Mo-Bi systems exhibit good selectivity towards methanol, one of the most interesting CO_2 reduction products.[3]

This poster will present some of our recent results on the synthesis, characterization and study of the (electro)catalytic properties of different materials prepared by grafting molybdenum-based precursors ($Mo(CO)_6$, $MoCl_5$, polyoxomolybdates) on either TiO_2 particles or TiO_2-coated fluorine tin oxide (FTO) electrodes. The CO_2 reduction ability of these systems has been followed by spectroscopy (IR, UV-Vis) and electrochemistry, and the reduction products analyzed by on-line GC and HPLC techniques.

[1] *Green Carbon Dioxide: Advances in CO_2 Utilization*; G. Centi, S. Parathoner, Eds.; John Wiley & Sons: Hoboken, NJ, **2014**.
[2] Y. Oh, X. Hu, *Chem. Commun.*, **2015**, 51, 13698.
[3] X. Sun, Q. Zhu, X. Kang, H. Liu, Q. Qian, Z. Zhang, B. Han, *Angew. Chem. Int. Ed.,* **2016**, 55, 6771.