

**Mo-based catalysts for CO<sub>2</sub> (electro)reduction**J. Compain, D. Nater<sup>1</sup>, C. Copéret<sup>1\*</sup><sup>1</sup>ETH Zürich

Though CO<sub>2</sub> 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.<sup>[1]</sup> Unfortunately, with carbon in its highest oxidation state, CO<sub>2</sub> is a highly stable molecule (C=O bond: 803 kJ.mol<sup>-1</sup>) 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<sub>2</sub> 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<sub>2</sub> reduction properties have received little attention. However, two recent results have been hinting to its potential as a catalyst: commercial MoO<sub>2</sub> microparticles have been shown to present electrocatalytic CO<sub>2</sub> reduction abilities, especially in the presence of an ionic liquid as co-catalyst,<sup>[2]</sup> and some mixed Mo-Bi systems exhibit good selectivity towards methanol, one of the most interesting CO<sub>2</sub> reduction products.<sup>[3]</sup>

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)<sub>6</sub>, MoCl<sub>5</sub>, polyoxomolybdates) on either TiO<sub>2</sub> particles or TiO<sub>2</sub>-coated fluorine tin oxide (FTO) electrodes. The CO<sub>2</sub> 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<sub>2</sub> 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.