NOVEL BINARY M_xO_y-SiO_2 POROUS SELF-STANDING CATALYST FOR CO OXIDATION

A. Vardon[a], I. Ly[a], F. Nallet[a], F. Epron[b], N. Chanut[c], C. Especel[b], T. Pigot[d], R. Backov[a]

[a]CRPP-UMR 5031 CNRS, Université de Bordeaux, 33600 Pessac, France
[b]IC2MP-UMR 7285 CNRS, Université de Poitiers, 86073 Poitiers, France
[c]Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA
[d]IPREM-UMR 5254 CNRS, Université de Pau et des pays de l'Adour, 64053 Pau, France

Environmental protection is a major concern for our industrial societies. In order to prevent the release of some pollutants, catalysts have been developed with the endeavor of minimizing the use of noble metals. To address these issues, new self-supporting materials bearing hierarchical porosity have been synthesized by combining physical chemistry of complex fluids and sol-gel process.[1] These materials are new and require multitechnique characterizations to fully understand their organization at various scales. SEM-EDS, mercury porosimetry and Helium picnometry are first used to probe the macroscopic scale. Secondly at the mesoscopic scale by gas physisorption, TEM, SAXS are employed. And at the microscopic scale XRD, TGA and ICP allow defining the molecular phase and associated stoichiometry. The catalytic properties of the materials are then demonstrated by studying the reaction of CO oxidation. In this presentation, we will focus on series of monolithic macro-mesocellular M_yO_x-Si(HIPE) (Fig. 1a), particularly $Co_xO_ySiO_2$(HIPE) and $Cu_xO_ySiO_2$(HIPE). When these materials are used for the oxidation of CO to CO_2 (Fig. 1b),[2,3] CO stream was fully convert to CO_2 before 200°C while reaching 50% conversion at 145°C. On this vein, oxidized copper phases Cu_xO_ySi(HIPE) were reduced as Cu°Si(HIPE), where very efficient performances for CO oxidation are obtained while offering thermodynamic stability when cycling under humid conditions. All these results will be discussed in details in terms of heterogeneous catalysis dedicated towards environmental remediation.

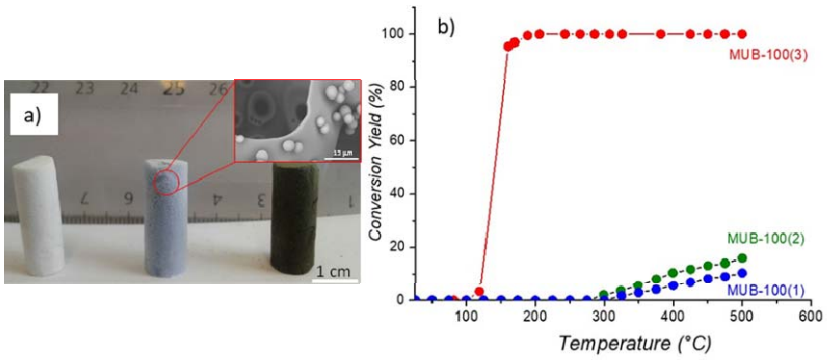

Figure 1 : Monolitic character of the cobalt oxides based MUB-100 materials observation at the macroscopic length scale. a) from left to right MUB-100(1), MUB-100(2) and MUB-100(3) where the cobalt content is increasing. b) CO conversion (%) vs temperature for MUB-100(1) (blue dots), MUB-100(2) (green dots) and MUB-100(3) (red dots).

[1] Carn, F. et al. *J. Mater. Chem.* 2004, *14*, 1370-1376.

[2] Ly, I. et al. *Appl. Nano Mater.* 2022, *5*, 7331-7343.

[3] Vardon, A. et al. *Chem. Mater.* 2023, *1*, 228-241.