LIGHT TRAPPING WITHIN 3D MACROCELLULAR CERAMICS TOWARDS ENVIRONMENTAL REMEDIATION

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Photochemistry and photocatalysis have been the subject of numerous studies in the past decades. In particular, gas phase photocatalysis is of promising interest when considering air remediation, especially indoor pollution often worse than the outdoor one. To address these issues, novel hierarchical silica architectures have been designed while combining sol-gel chemistry and complex fluids, leading to multiscale porous heterogeneous self-standing catalysts [1,2]. By the association of silica scaffolds with various oxides (TiO_2, WO_3, …) photonic sponges were obtained. In this context we overcome one major drawback of gas photocatalysis i.e. the number of layers efficiently activated by light irradiation. Through a colloid approach, by introducing TiO_2 nanoparticles into the silica matrix, catalysts exhibiting efficient VOCs (acetone) photo-oxidation were designed while acting in volume [3].

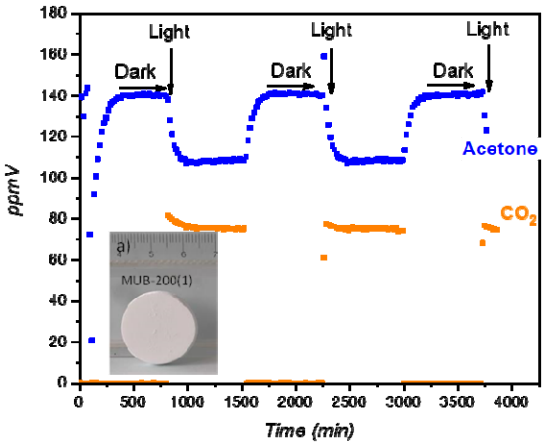

Figure 1. TiO_2@SiO_2 ceramic and acetone/CO_2 concentrations during a photocatalytic test (dark periods correspond to the material's saturation with acetone).

These materials can also be used for heterogeneous catalysis in liquid phase. Indeed, when the final structure is Nb_2O_5@SiO_2, the catalysts offer efficient and selective solvent and super-acid free Friedel-Crafts alkylation and acylation reactions, with up to 100% conversion at 140°C [4]. These materials can be thus tuned to target certain applications making them versatile in addition of being easily synthesized, handable, and recovered. These results will be discussed in terms of environmental issues offering "out of the box" efficient and robust monolithic self-standing heterogeneous catalysts.

[1] I. Ly et al., **2022**, *ACS Appl. Nano Mater.*, 5, 7331-7343, DOI: 10.1021/acsanm.2c01258

[2] S. Bernadet et al., **2019**, *ACS Adv. Funct. Mater*, 29, 1807767, DOI: 10.1002/adfm.201807767

[3] E. Layan et, **2023**, *Langmuir*, DOI: 10.1021/acs.langmuir.2c03062

[4] I. Ly et al., **2022**, *ACS Appl. Mater. Interfaces*, 14, 13305-13316, DOI: 10.1021/acsami.1c24554