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# ABSTRACT:

## Silica-based porous catalysts for efficient $CO_2$ capture and methanation: a closer look at the surface.

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Dual function materials are becoming more and more appealing to develop efficient and cost-effective $CO_2$ capture, storage and re-use catalytic systems in a decarbonization approach. In this field, mesoporous silicas can be proposed as an alternative to the widely investigated alumina catalytic support [1]. This presentation will focus on a series of $Ru/Ba/SiO_2$ ternary catalysts, developed in form of powders synthetized by sequential impregnation of commercial silica, and tested in $CO_2$ adsorption and methanation process. IR spectroscopic investigations highlighted the complex properties of these surfaces, characterized by basic sites, weakly acidic silanol groups and the formation of a complex population of carbonated species following $CO_2$ adsorption-desorption experiments. In the framework of the SILCO project [2], the optimized formulations selected are now being applied to the preparation of catalysts based on silica from wastes, namely silica derived from hexafluorosilicic acid, a hazardous by-product of the phosphate and aluminum fluoride industries. Through a precipitation step, and the incorporation of organic templates, mesoporous and macroporous silica were produced, with diversified morphology and surface properties consistent with commercial materials. Silica from wastes can be promising candidates as support for methanation catalysts.

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[1] A. Porta, R. Matarrese, C. Visconti and L. Lietti, Energy Fuels, 37, 7280 (2023).
[2] www.silco.polimi.it