ABSTRACT:

CO_2 Hydrogenation Mechanisms Investigation Via IR Spectroscopy

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In the last decades, concerns about air quality in environment and sustainability of industrial activities have requested a continuous development of efficient catalytic converters, being heterogeneous catalysis a pivotal step in the production of all the needs of mankind. Not only the air quality is on the way to be improved via a better abatement of the pollutants, but also the use of catalysts and processes which economize rare elements, energy, and avoid the use of hazardous compounds represents the way for sustainability. Among other concerns the decrease of carbon dioxide impact, its capture and reuse have stimulated the field of research in heterogeneous catalysis.
In the present talk we will present different proofs of concept in the domain of heterogeneous catalysis, based on the approach of reaction mechanism investigation to identify the main parameters for process enhancement. We will show the assessment of the reaction mechanism of carbon dioxide methanation on nickel supported on ceria- or alumina-based catalysts, and alternative catalysts based on ruthenium. It will be of high interest to represent all the reaction intermediates and their outbreak sequence, thanks to quantitative infrared analysis, as well as the explanation of product selectivity [1,2].

[1] P.A. Ussa Aldana, F. Ocampo, K. Kobl, B. Louis, F. Thibault-Starzyk, M. Daturi, P. Bazin, S. Thomas, A.C. Roger, Catal. Today, 215, 201 (2013).
[2] S.E. Atakoohi, E. Spennati, P. Riani, M. Daturi, G. Busca, G. Garbarino, Appl. Catal. A, General 707, 120625 (2025).