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ENERGYPOLIS SEMINAR

6. 7. 2018, 11:30 - 12:30, ENERGYPOLIS Sion, 4th floor, Seminar room

Utilization of CO_2 in the production of synthetic fuels and chemicals

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The availability of excess renewable power and the need of reducing the CO_2 footprint of energy and chemical processes brought about new opportunities for the production of C-neutral fuels and chemicals. This work presents three alternative catalytic processes studied in the last few years at Politecnico di Milano that can potentially use recovered CO_2 and renewable H_2 to synthetize gaseous or liquid fuels with a wide marked and/or added-value chemicals. The first technology considered exploits a Ru-based catalyst to make synthetic natural gas out CO_2/H_2 mixtures [1]. Our main contributions to the field has been the description of the process kinetics in a wide range of process condition relevant to industrial operations and the analysis of mass transport limitations for catalyst pellets suitable to be used in technical fixed bed reactors. The second process considered aims at converting CO_2/H_2 mixtures in liquefiable (LPG) or liquid (diesel and gasoline) fuels. To this aim, Fe- and Co-based catalysts are used and operations under pressure are carried out [2]. Our attention has been focused in this case on the catalytic aspects driving the process selectivity and the possibility to modify the catalyst properties so to tailor the obtained products. The third process considered is again based on Fe-based catalysts, which have been modified in this case to maximize the yield to C_2-C_4 olefins, the well-know building-blocks of the petrochemistry sector [3]. Our interests were concentrated in the catalysts design, which has to be optimized so to limit the formation of either methane and C_5+ species, while boosting the synthesis of unsaturated hydrocarbons at the same time.

References:

[1] L. Falbo, M. Martinelli, C.G. Visconti, L. Lietti, C. Bassano, P. Deiana, *Appl. Catal. B: Env. 225 (2018) 354.*
[2] C.G. Visconti, M. Martinelli, L. Falbo, L. Fratalocchi, L. Lietti, *Catal. Today 277 (2016) 161*
[3] C.G. Visconti, M. Martinelli, L. Falbo, A. Infantes-Molina, L. Lietti, P. Forzatti, G. Iaquaniello, E. Palo, B. Picutti, F. Brignoli, *Appl. Catal. B: Env. 200 (2017) 530.*

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Born in 1960 in Como, Italy, Luca Lietti is full professor at Politecnico di Milano since 2001. His major interests are in the field of heterogeneous catalytic processes, especially for energy and the environment. He is author of more than 180 papers published on international journals and 3 patent applications. His h-index is 50.

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