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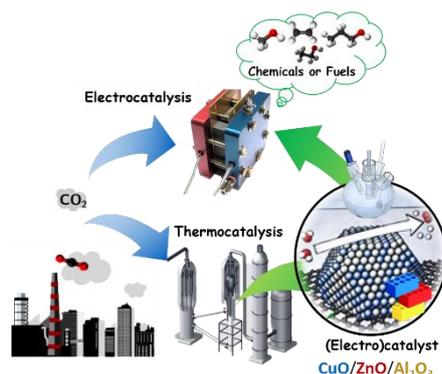
## Catalytic vs. electrocatalytic reduction of CO<sub>2</sub> to added-value products

Hilmar Guzmán,<sup>a,b</sup> Fabio Salomone,<sup>a</sup> Samir Bensaid,<sup>a</sup> Nunzio Russo,<sup>a</sup> and Simelys Hernández<sup>a,b</sup>

<sup>a</sup> Department of applied science and technology (DISAT), Politecnico di Torino, C.so Duca degli Abruzzi, 24, 10129-Turin, Italy

<sup>b</sup> Center for Sustainable Future Technologies, IIT@Polito, Istituto Italiano di Tecnologia, Via Livorno, 60, 10144-Turin, Italy  
E-mail: [hilmar.guzman@polito.it](mailto:hilmar.guzman@polito.it)

The increase of CO<sub>2</sub> concentration in the atmosphere after industrial revolution plays a critical role in global climate changes. Therefore, to mitigate CO<sub>2</sub> emissions into the atmosphere, CO<sub>2</sub> can be exploited as a raw material to synthesize high added-value products (*i.e.* methanol) [1]. The electrochemical reduction of CO<sub>2</sub> is a sustainable and technologically interesting process that, driven by renewable energy sources, can be used to capture and store both renewable energy and CO<sub>2</sub> in the form of chemicals or fuels [2]. However, the main challenge is to find a suitable electrocatalyst to establish this technology at an industrial level. In such context, our group have exploited the basic knowledge of thermochemical catalysis to understand the synergies between these two processes (see Figure 1) and make faster progress in the development of an optimal electrocatalyst [3]. A commercial catalyst (*i.e.* CuO/ZnO/Al<sub>2</sub>O<sub>3</sub>) active for the thermocatalytic CO<sub>2</sub> reduction to CH<sub>3</sub>OH at P = 25 bar and T > 200°C (with selectivity ≤ 20%), was tested for the electrocatalytic CO<sub>2</sub> reduction at atmospheric conditions, demonstrating different products in the C<sub>1</sub>-C<sub>3</sub> range with an overall selectivity (faradaic efficiency) of about 70%. Our results paved the way to the development of new and highly efficient electrocatalytic systems for CO<sub>2</sub> capture and utilization by electrochemistry.



**Figure 1.** Synergies between thermo- and electro- catalysis for CO<sub>2</sub> conversion to added-value products.

[1] S. Hernandez, M.A. Farkhondehfal, F. Sastre, M. Makkee, G. Saracco, N. Russo, *Green Chem.* **19** (2017) 2326-2346.

[2] I. Ganesh, *Renew. Sustain. Energy Rev.* **59** (2016) 1269-1297.

[3] A. Wieckowski, M. Neurock, *Advances in Physical Chemistry* (2011) 1-18.

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