Catalytic vs. electrocatalytic reduction of CO2 to added-value products

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The increase of CO_2 concentration in the atmosphere after industrial revolution plays a critical role in global climate changes. Therefore, to mitigate CO_2 emissions into the atmosphere, CO_2 can be exploited as a raw material to synthesize high added-value products (*i.e.* methanol) [1]. The electrochemical reduction of CO_2 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_2 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.* $CuO/ZnO/Al_2O_3$) active for the thermocatalytic CO_2 reduction to CH_3OH at P = 25 bar and T > 200°C (with selectivity ≤ 20%), was tested for the electrocatalytic CO_2 reduction at atmospheric conditions, demonstrating different products in the C_1-C_3 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_2 capture and utilization by electrochemistry.

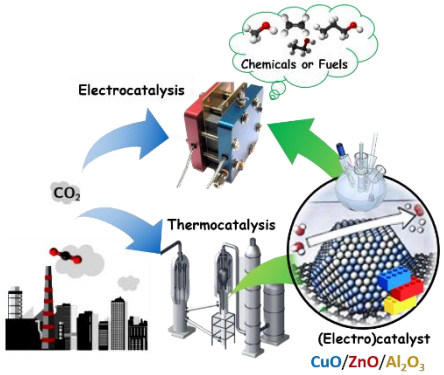

Figure 1. Synergies between thermo- and electro- catalysis for CO_2 conversion to added-value products.

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