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DESIGN OF MULTI-COMPONENT CATALYSTS FOR THE ELECTROCHEMICAL CONVERSION OF CO2 INTO VALUABLE FUELS AND CHEMICALS

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Project Summary: Combining the electrochemical reduction of CO_2 (eCO_2RR) with carbon-neutral energy sources is an attractive strategy for recycling carbon emissions, but its application still requires breakthrough advances in terms of catalytic performance. The emergence of synergistic effects in multi-component systems (e.g. alloys, supported nanoparticles) is a promising avenue for the development of improved catalysts for this reaction. In this context, this study has unveiled the key role of catalyst evolution and of metal-oxide interactions in In-modified Cu- and Ag-based catalysts. Aiming to gain insights on the nature of bifunctional sites in these materials and derive structure-activity relationships to guide the development of multi-component electrocatalysts, a versatile photolithographic microfabrication process for model electrodes with controlled interfacial geometry has been devised. In addition, the introduction of p-block elements was demonstrated as a powerful strategy to tune the selectivity of Cu-based materials, as evidenced by the enhanced selectivity toward alcohols and hydrocarbons over Al-doped Cu_2O and the discovery of sulfide-derived Cu as a highly selective electrocatalyst for formate production.

CV: Gastón Larrazábal completed his undergraduate studies in Chemical Engineering at Simón Bolívar University in Caracas, Venezuela (2010). Following a year of experience in the pharmaceutical industry, he obtained his MSc in Process Engineering at ETH Zurich (2013) and then joined the group of Prof. J. Pérez-Ramírez for his PhD studies.