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Investigation of CuAl-layered double hydroxides as efficient electrocatalysts of CO₂ reduction

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The emission of CO₂ by industrial action has a serious impact on our environment which leads us to look for ways to decrease the emitted CO₂ to the atmosphere. The electrochemical conversion of CO₂ (CO₂ER) into other molecules such as CO, HCOOH, CH₃COOH, and CH₄ is one of the many ways to achieve this goal. Not only it will help to reduce pollution, but it will also convert CO₂ to valuable products to use as a feedstock.^[1] Recently, efficient copper based electro-catalysts for CO₂ER were prepared from layered double hydroxides (LDH) ^[2]. Using CuAl-NO₃ LDH prepared by the coprecipitation method and thermal treatments, a morphology control allowed to improve the catalytic activity by tailoring the structure of active sites and increasing the surface area/number of active sites. The resulting catalyst promoted the electrochemical conversion, in galvanostatic conditions, of CO₂ to CO and HCOOH with a faradaic efficiency (FY) up to 42% and 22%, respectively.

In the present work, the influence of the chemical composition of Cu based LDH of both the layer and the interlayer domain on the CO₂ER was studied. Several copper based LDH were synthesized by varying the synthetic method and taking into account the Cu/Al ratio and the interlayer anion (CO₃²⁻, Acetate Ac and dodecylsulfate SDS). The electrochemical behavior of these phases was first studied in cyclic voltammetry in different electrolytes under CO₂ saturated atmosphere in order to put in light their electrocatalytic behavior towards CO₂ER. The experimental parameters were optimized to perform the macroscale electrolyses. Among the different phases tested, Cu₂Al-CO₃ LDH phase prepared by coprecipitation showed the highest faradic yield of HCOOH in 0.5 M KCl, reaching 48%.

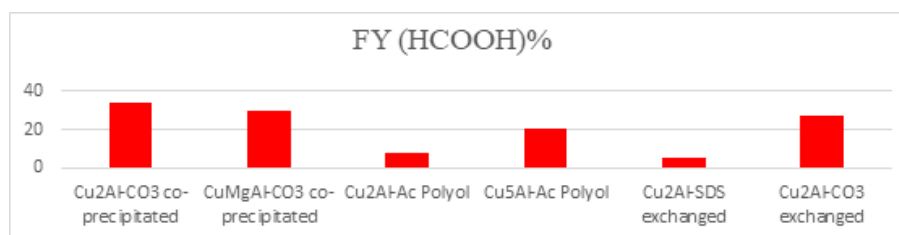


Figure.1: Faradic yields of HCOOH formation by copper based LDH synthesized by different methods in 0.45 M KHCO₃

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