Electrochemical Characterisation of Cu Clusters and Well Defined Extended Surfaces

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Copper (Cu) is the only monometallic electrocatalyst that can reduce carbon dioxide (CO_2) into hydrocarbons and alcohols [1]. The selectivity towards certain products is thereby dependent on the properties of the electrolyte as well as the catalyst itself [2]. While electrolyte properties such as cation and anion identity are determined by the choice of the electrolyte and remain constant during the reaction the catalyst is prone to morphological changes. It has been shown in the literature that polycrystalline Cu electrodes reconstruct under CO_2 reduction conditions to Cu(111) and subsequently to Cu(100) [3]. If nanoparticles or clusters are used as electrocatalysts morphological changes can result additionally from particle sintering [4]. In general detection of these structural changes relies on in situ experiments at the synchrotron or quasi in situ electrochemical scanning tunneling microscopy [3,5]. Herein we demonstrate an electrochemical approach to characterise Cu-based electrocatalysts based on measurements performed over well defined extended Cu surfaces. Furthermore, we extend these measurements to investigate the transient morphological changes experienced by nanoscopic Cu clusters during CO reduction.

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