Understanding Electrocatalyst Re-structuring during Reaction with Electrochemical Cell Transmission Electron Microscopy

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Understanding the nature of functional materials in their operating environments is crucial for unravelling their structure-property relationships and enabling the design of materials with better performance. In recent years, there have been significant strides in instrumentation that allow us to study samples within liquid and gas environments inside a transmission electron microscope (TEM) [1]. Particularly. electrochemical cell TEM (EC-TEM) is emerging as a powerful technique for studying the morphology of electrocatalysts in an electrolyte and under applied potential. In this seminar, I will discuss the work in my group using EC-TEM to reveal the structural transformations that take place in catalysts under reaction conditions. First, I will briefly cover basic concepts of EC-TEM. Then, I will show using examples from our work on Cu-based electrocatalysts for electrochemical CO_2 reduction how complex structural motifs are created due by the restructuring of pre-catalysts under applied potential and the impact that these motifs have on the electrocatalysts' properties [2. 3]. Lastly, I will briefly touch on our current work combining operando EC-TEM and time-resolved energy-dispersive X-ray spectroscopy to track both catalyst morphology and chemical state during reaction [4].

References:

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