Activity – or Lack Thereof – of RuO₂ Based Electrodes in the Electrocatalytic Reduction of CO₂

RuO₂-based electrodes have been extensively studied for several electrochemical reactions. Earlier literature works claim RuO₂-based catalysts to be active also for the electrocatalytic conversion of CO₂ to methanol with high selectivity at very low overpotentials. Here we report a thorough investigation of RuO₂ films and particles for the electrocatalytic reduction of CO₂. The different experimental configurations explored in our work showed that H₂ is basically the only reaction product under CO₂ reduction conditions in contrast to earlier reports. In situ surface enhanced infrared absorption spectroscopy (SEIRAS) measurements revealed that CO bound to the RuO₂ surface, albeit acting solely as spectator species. Our experiments indicated that adsorbed CO cannot be reduced further to methanol or other CO₂ reduction products.

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