Electrochemically Generated Copper Carbonyl for Selective Dimethyl Carbonate Synthesis

Development of electrochemical synthesis routes for high-value chemicals could pave the way for a sustainable chemical industry based on electricity. Herein, the electrochemical synthesis of the industrially relevant and environmentally benign reagent, dimethyl carbonate (DMC), is investigated. By utilizing a combination of electrochemical techniques, in situ infrared spectroscopy, and headspace-gas chromatography-mass spectrometry we show production and spectroelectrochemical evidence for the synthesis of DMC via an electrochemically generated copper carbonyl species. The formation of the copper carbonyl has close to 100% current efficiency, in the applied potential range of 0.1-0.4 V vs SCE. Subsequent formation of DMC occurs with a slow reaction time on the order of 30-40 days. Relative to potential coproducts, the reaction is highly selective for DMC. Optimization of the reaction may lead to a viable method of DMC production.