Optimized Ag Nanovoid Structures for Probing Electrocatalytic Carbon Dioxide Reduction Using Operando Surface Enhanced Raman Spectroscopy

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Motivation

Electrochemical reactions can be probed by surface enhanced operando Raman Spectroscopy (SERS). Plasmonic metallic nanostuctured substrates enhance the Raman signal intensity of analyte molecules by several orders of magnitude.[1]

Using that methodology, we report:

- Fabrication of Ag nanovoid SERS substrates by a Langmuir-Blodgett approach and subsequent bipolar electrodeposition
- Optimization of Ag-nanovoid substrates towards their highest Raman enhancement
- Operando Raman spectra suggest CO and C2 product formation

References


Conclusions

- Layer thickness void gradient electrodeposited by bipolar electrochemistry
- Ag nanovoids were optimized towards their highest signal enhancement
- Highest enhancement achieved with 300 nm nanosphere templates and a void opening of 190 nm
- Signal enhancement sufficient to study the CO2RR by operando Raman spectroscopy
- Results suggest the formation of CO and C2 products in contrast to the widely accepted EtOH, MeOH and HCOOH product preference

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