

Electrochemical Ethylene Glycol Oxidation on Cobalt Oxide-Based Spinels in Flow Conditions.

[Adarsh Koul](#), [Shubhadeep Chandra](#), [Thomas Quast](#), [Wolfgang Schuhmann](#)¹

Lehrstuhl für Analytische Chemie, Ruhr University Bochum, Germany

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E-Mail presenting authors: adarsh.koul@ruhr-uni-bochum.de

The current bottleneck for producing green hydrogen via electrochemical water electrolysis is the oxygen evolution reaction (OER) due to its high overpotentials. Alcohol oxidation reactions can serve as a substitute for OER, requiring lower energy input due to lower oxidation potentials for alcohol while concomitantly producing potentially value-added products. Ethylene glycol (EG), the smallest polyol, has recently gained interest as a reactant, aiming at partial-oxidation products like glycolic acid, oxalic acid, and formic acid.^[1]

An efficient EGOR would require a stable catalyst with low overpotential. Cobalt oxide has shown promising properties towards oxidation reactions such as the OER, methanol, and ethanol oxidation, and hence it can be used as a model catalyst to study EGOR.^[2] We received Co₃O₄ spinels from projects C01, C02 and C03 of CRC/TRR247 prepared via various synthesis routes. These catalysts were drop-coated under reduced pressure onto a carbon paper electrode which was used as working electrode in a lab-scale flow-through electrolyzer. The initial goal was to understand the effect of the synthesis procedure on the electrochemical response. Electrochemical techniques like cyclic voltammetry and impedance spectroscopy were used for an initial electrochemical characterization of the materials followed by long-term chronoamperometric measurements at varying potentials. Electrolyte samples collected during the electrolysis were analyzed by means of HPLC to evaluate the selectivity of the EGOR. Various products like glycolic acid, oxalic acid and formic acid were detected. The study was extended to V and Mn doped spinels with varying small amounts of the doping elements and electrochemical protocol was repeated for these compounds to understand the effect of doping on the electrocatalytic activity as well as the selectivity and product distribution.

[1] H. Zhou *et al.*, Nat. Commun., 2021, **12**, 4679, <https://doi.org/10.1038/s41467-021-25048-x>.

[2] S. Iravani *et al.*, Green Chem., 2020, **22**, 2643, <https://doi.org/10.1039/D0GC00885K>