Understanding of the formation of active sites with pulsed laser-post treating of catalysts.

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Identifying the active sites and understanding the mechanisms of the reaction is important to improve catalyst performance in a targeted way. In the past, we have introduced defect engineering and structural tuning in terms of the inversion parameter in $CoFe_2O_4$ ferrites [1] and Co_3O_4-spherical nanoparticles [2] using Pulsed Defect Engineering in Liquid (PUDEL) in a flat liquid jet setup, which allowed us to precisely control the effective laser intensity. However, the use of nanoparticles (real catalysts) also results in higher structural complexity which makes the identification of the active sites by combining theoretical and experimental methods complicated. Consequently, in the present work, we extend the defect engineering and surface diffusion capabilities of PUDEL towards thin film systems (model catalysts) by writing defined doping arrays into single faceted Co_3O_4 (111) thin films. The activity for ethylene glycol oxidation and oxygen evolution reactions of the individual laser-written doping spots was characterized via scanning electrochemical cell microscopy (SECCM). Overall, we present first results of a pulsed-laser-based method to understand defect and metal ion doping effects on oxidation catalysis in the liquid phase.

[1] S. Zerebecki *et. al.*, ChemCatChem, 2022, **14,** doi:10.1002/cctc.202101785.

[2] S. Zerebecki et. al., J. Phys. Chem. C, 2022, **126**, 15144–15155, doi:10.1021/acs.jpcc.2c01753.