

Article

Supplementary material: Combining planar laser-induced fluorescence with stagnation point flows for small single-crystal model catalysts: CO oxidation on a Pd(100)

Jianfeng Zhou ¹, Sebastian Matera ², Sebastian Pfaff ¹, Sara Blomberg ^{3,4}, Edvin Lundgren ⁵ and Johan Zetterberg ^{1*}

¹ Division of Combustion Physics, Lund University, SE-22100 Lund, Sweden; jianfeng.zhou@forbrf.lth.se (J.Z.); Sebastian.pfaff@forbrf.lth.se (S.P.)

² Institute for Mathematics, Freie Universität Berlin, D-14195 Berlin, Germany; matera@math.fu-berlin.de

³ Department of Chemical Engineering, Lund University, SE-22100 Lund, Sweden; Sara.blomberg@chemeng.lth.se

⁴ Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, 94720-8229, California, USA

⁵ Division of Synchrotron Radiation Research, Lund University, SE-22100 Lund, Sweden; Edvin.lundgren@sljus.lu.se

* Correspondence: johan.zetterberg@forbrf.lth.se

The CO₂ distribution over a Pd(111) single crystal (2 mm thick) has been studied with PLIF to demonstrate the effect of active edges of the sample in a non-stagnation flow geometry (as shown in S1). The measurement was performed with 4:4:92 ratio of CO, O₂ and Ar at 150 mbar total pressure and 100 ml_n/min total flow. The results are summarized in S2. The PLIF images recorded at different temperatures during the ramp up, as shown in S1 (a-c), reveal that the sides of the sample become active before the (111) surface. Compared to the stagnation flow case in Figure 2, there are two distinct steps in both the PLIF and MS trends of the CO₂ signal, as shown in S2 (d) and (e) respectively. The PLIF image in S2 (b) and the PLIF trends in S2 (d) clearly demonstrate that there is a significant amount of CO₂ signal that spills over from the sides to the (111) surface. This spill-over signal could be a potential problem when one tries to correlate the activity (indicated by the production of CO₂ in the gas phase) with the surface change of a catalyst sample in *operando* studies, if 2D spatially resolve information is lacking.

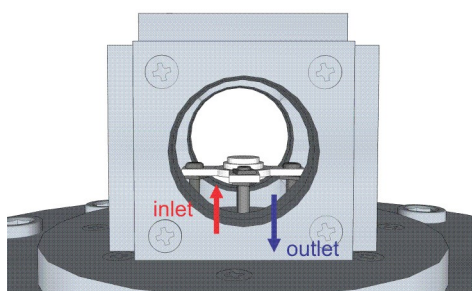


Figure S1. A reactor with a non-stagnation flow geometry. The gas inlet and outlet are indicated by the red and blue arrow, respectively.

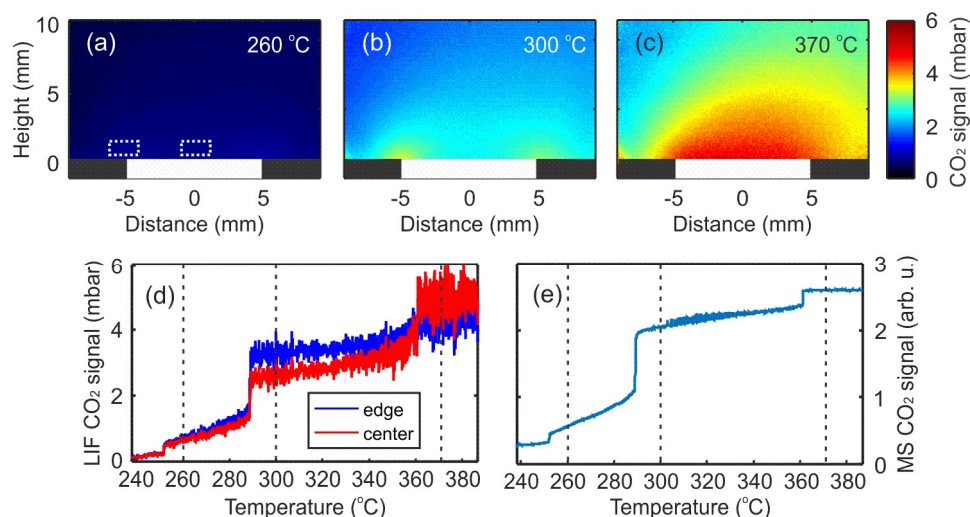


Figure S2. CO₂ distribution over a Pd(111) single crystal during CO oxidation. (a–c) PLIF 10-shot average images recorded at different temperatures during the ramp up. (d) The integrated PLIF trends 0.5 mm above the sample at the edge (blue), at the center (red). (e) The MS signal measured at the gas outlet. The white rectangular indicates the sample.



© 2018 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).