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Componential perturbation induced transient evolution of CO oxidation studied by time resolved APXPS

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Herein, we operated the fast gas pulse set-up coupled with APXPS at HIPPIE beamline to map the transient evaluation of CO oxidation reaction on Pt(111) single crystal surface with sub-millisecond time resolution. To elaborate the reaction mechanism, two strategies were designed and implemented: one pulse, two pulses experiment.

In the one pulse experiment, CO was pulsed onto the sample surface joining in a constant O2 flow to react at the surface under reaction temperature. Mapping of CO pulse reveals reaction only happened on the rising edge, and CO2 production rendered an upward trend with a decrease in frequency of event from 40 HZ to 2.5 HZ. The diversity of reactivities at different stage of a pulse and at different periods can be correlated to the corresponding surface species of each time window (before pulse, rising edge, top site, falling edge).

The reactant gases, CO and O2 were pulsed to the sample surface alternatively via manipulating time delay of the two gas pulses, which can create oscillating local gas environments in the two pulses experiments. Thus, the oscillation of the local gas environment led to the fluctuation of surface species, which drove CO oxidation reaction away from steady state into nonequilibrium state.

Reference:

1. A. Shavorskiy. et al., ACS Appl. Mater. Interfaces 13, 47629 (2021)
2. J. Knudsen. et al., Nat. Comm. 12, 6117 (2021)

if "Other", please specify:

I apply for a travel grant

No

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