Contribution ID: **283** Type: **poster**

Probing active sites of Pt/CeO2 CO preferential oxidation catalysts using time-resolved x-ray absorption spectroscopy.

Thursday 19 September 2013 12:30 (2 hours)

During production of hydrogen it is important to decrease CO traces down to 10 ppm level because these traces can poison catalysts used in hydrogen fuel cells. CO preferential oxidation (PROX) catalysts selectively oxidize CO to CO2 without oxidizing hydrogen. Platinum nanoparticles supported on ceria (CeO2) are promising candidates for such catalysts. Pt selectively adsorbs CO which is then oxidized by oxygen provided by CeO2 somewhere at the Pt-CeO2 interface. It is of interest to identify and characterize the active site in order to understand the reactivity and selectivity for improving future PROX catalysts. We probed the changes in oxidation state and coordination environment of Pt/CeO2 PROX catalysts using modulation excitation X-ray absorption spectroscopy at the Pt L3 edge during periodic switches between the typical PROX conditions (1%CO+1%O2+50%H2 in inert atmosphere) and oxygen free conditions (1%CO+50%H2 in inert atmosphere). The main goal is to see whether periodic changes in the atmosphere composition lead to periodic changes in the coverage of active Pt sites by CO and oxygen and to detect how fast this process happens in comparison to the changes in the oxidation state of the ceria support providing active oxygen for CO oxidation.

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Session Classification: Poster session II and lunch