Journal Name

ARTICLE

Electronic Supplementary Information: Platinum Loaded Tin Dioxide: A Model System for Unravelling the Interplay between Heterogeneous Catalysis and Gas Sensing

Received 00th January 20xx,
Accepted 00th January 20xx

DOI: 10.1039/x0xx00000x

www.rsc.org/

David Degler[a], Sabrina A. Müller[b], Dmitry E. Doronkin[b,c], Di Wang[d], Jan-Dierk Grunwaldt[b,c], Udo Weimar[a] and Nicolae Barsan[a,*]

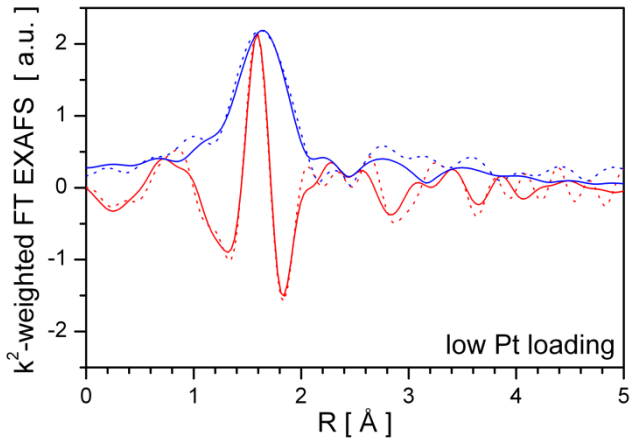

Figure S1. EXAFS fit the LL sample. The magnitude is shown in blue and the imaginary part in red. Solid lines represent the fit and dotted lines the experimental data.

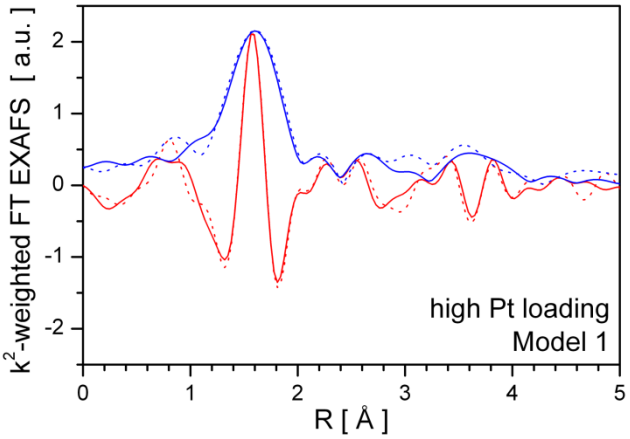

Figure S2. EXAFS fit (model 1) of the HL sample. The magnitude is shown in blue and the imaginary part in red. Solid lines represent the fit and dotted lines the experimental data.

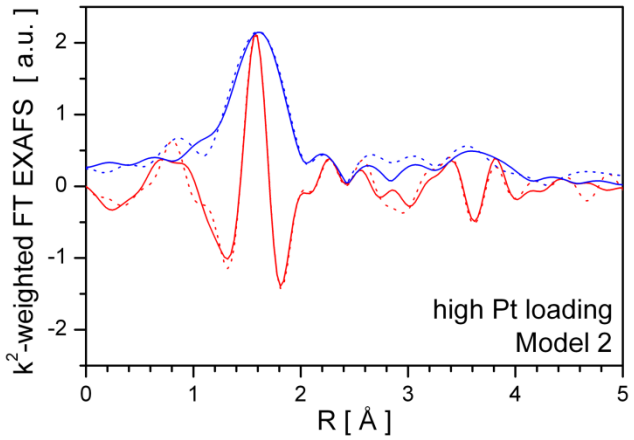

Figure S3. EXAFS fit (model 1) the HL sample. The magnitude is shown in blue and the imaginary part in red. Solid lines represent the fit and dotted lines the experimental data.

[a] Institute of Physical and Theoretical Chemistry (IPTC) and Centre for Light-Matter Interaction, Sensors & Analytics (LISA+), University of Tuebingen, Auf der Morgenstelle 15, D-72076 Tuebingen, Germany
[b] Institute for Chemical Technology and Polymer Chemistry, Karlsruhe Institute of Technology, Engesserstrasse 20, 76131 Karlsruhe, Germany
[c] Institute of Catalysis Research and Technology (IKFT), Karlsruhe Institute of Technology, Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany
[d] Karlsruhe Nano Micro Facility (KNMF), Karlsruhe Institute of Technology, Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany

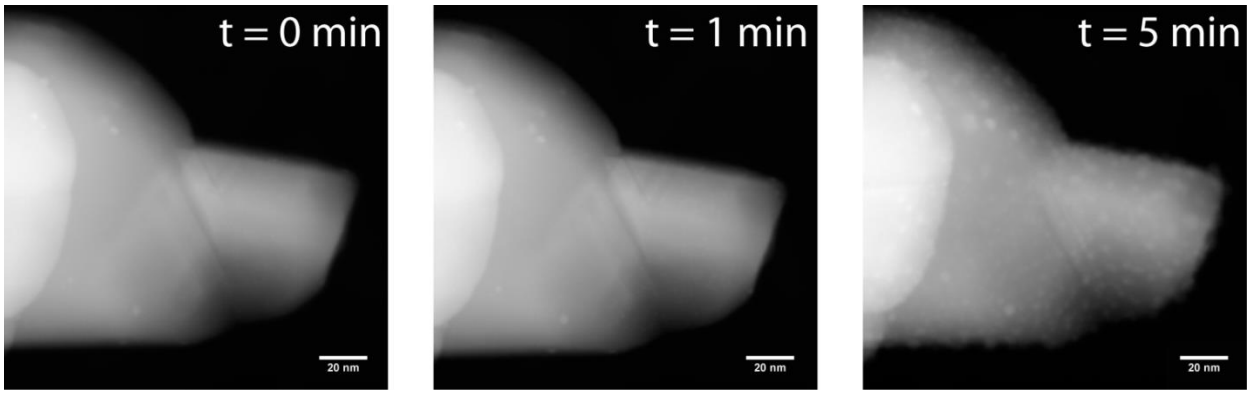

Figure S4. HAADF-STEM images of unused HL sample after 0, 1 and 5 min of electron beam exposure.

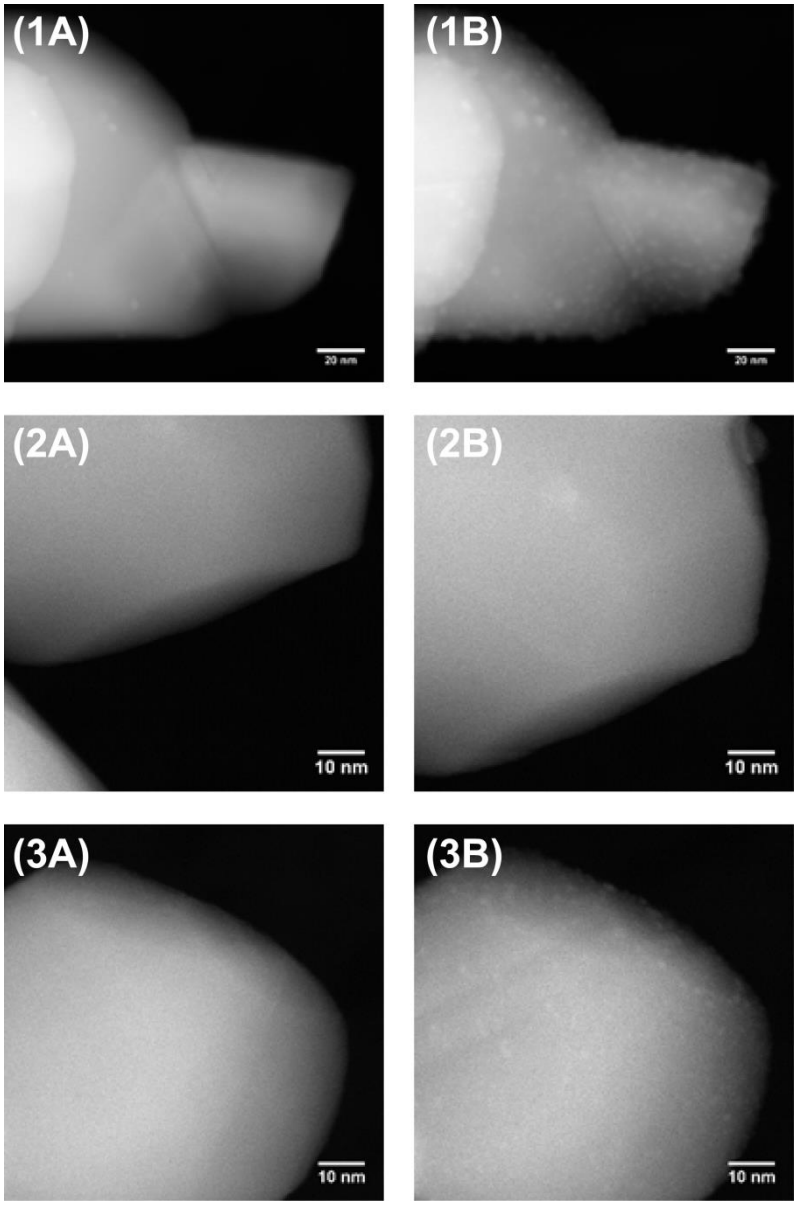

Figure S5. STEM-HAADF images of the unused (1) and used (2,3) sensor materials. The HL sample is shown in (1)and (3) and the LL sample in (2). On the left (A) the original material is shown and on the right (B) the one after beam exposure for 7 min (2B & 3B) or 5 min (1B). lowly Pt-loaded SnO_2 (A) original material, (B) after 7 min electron beam exposure (5 min in case of (1B)).

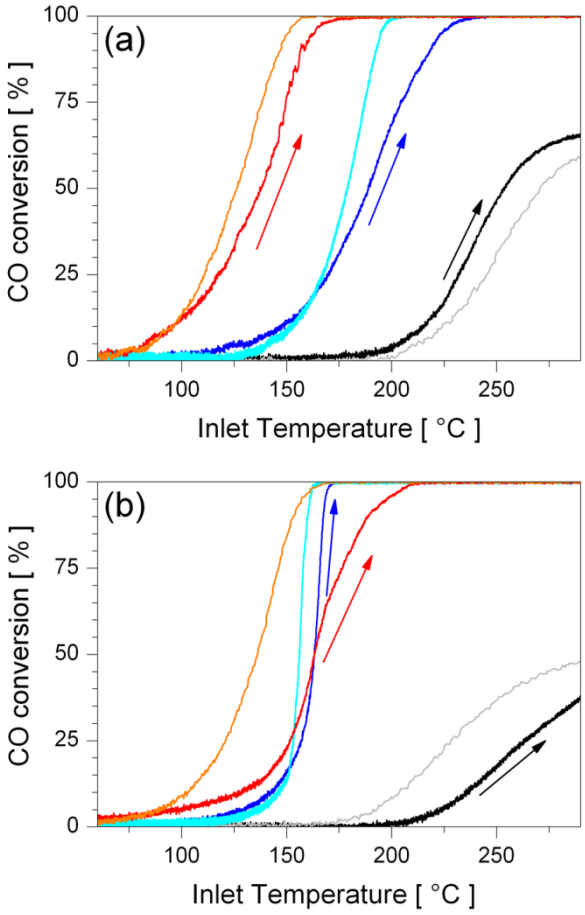

Figure S6. CO conversion curves (1st heating-cooling cycle) of SnO_2 (black/gray), LL (blue/cyan) and HL (red/orange) samples in dry air (a) and 50 % r.h. (b) CO containing atmosphere. The dark colors refer to the heating and the light colors to the cooling process of the catalysts (heating indicated by arrows); Catalyst amount: 100 mg, GHSV = 23000 h^{-1}, total gas flow 350 mL/Min, 300 ppm CO, 21 % O_2, N_2 balance.

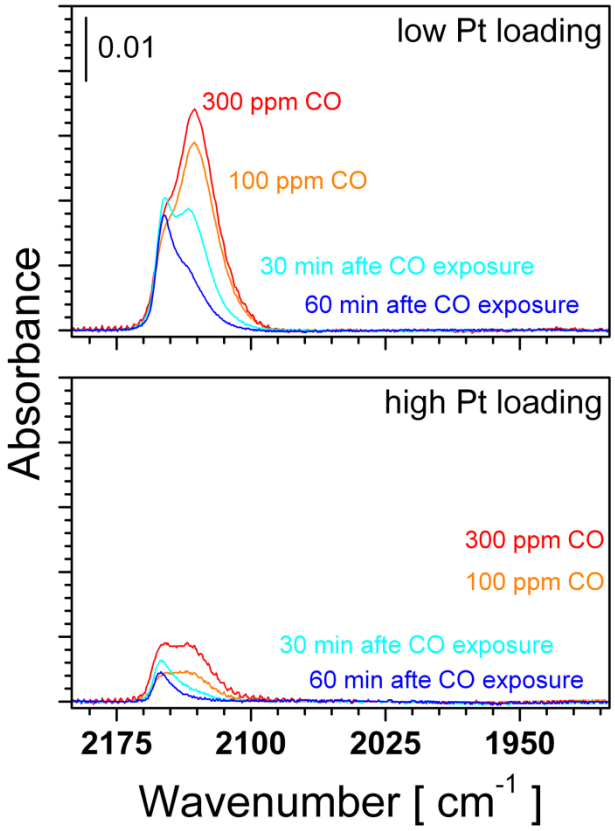

Figure S7. DRIFT spectra of LL (top) and HL (bottom) sample during and after the CO exposure at 300 °C in dry air.

Activation energy calculation

The activation energy of the used catalysts was calculated in the CO-conversion range of 2-8 % with the help of an Arrhenius plot. The slope of the linear fit was used to obtain E_A. The reaction rate was determined with equation S2.

$$ln(rate) = -\frac{E_A}{R} \cdot \frac{1}{T} \quad \text{(S1)}$$

$$rate = V_{CO}^{M} \cdot \dot{V_{CO}} \cdot Y \quad \text{(S2)}$$

V_{CO}^{M}: molar volume of CO at 298 K

$\dot{V_{CO}}$: gas flow of CO [mL/min]

Y: CO- conversion [%]

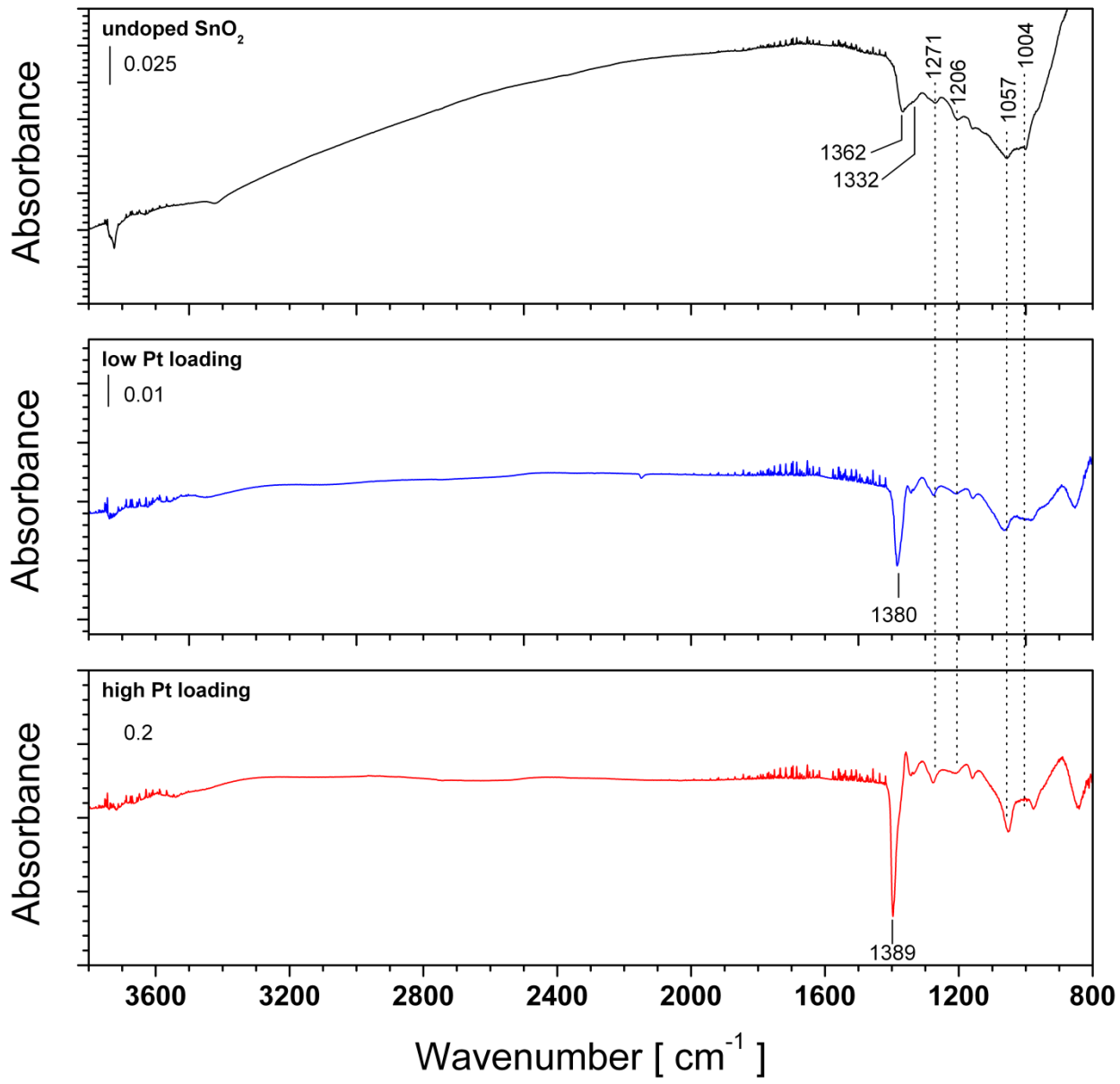

Figure S8. DRIFT spectra of the undoped (black), LL (blue) and HL (red) samples exposed to 10 % r.h.; the spectra are referenced to dry air.

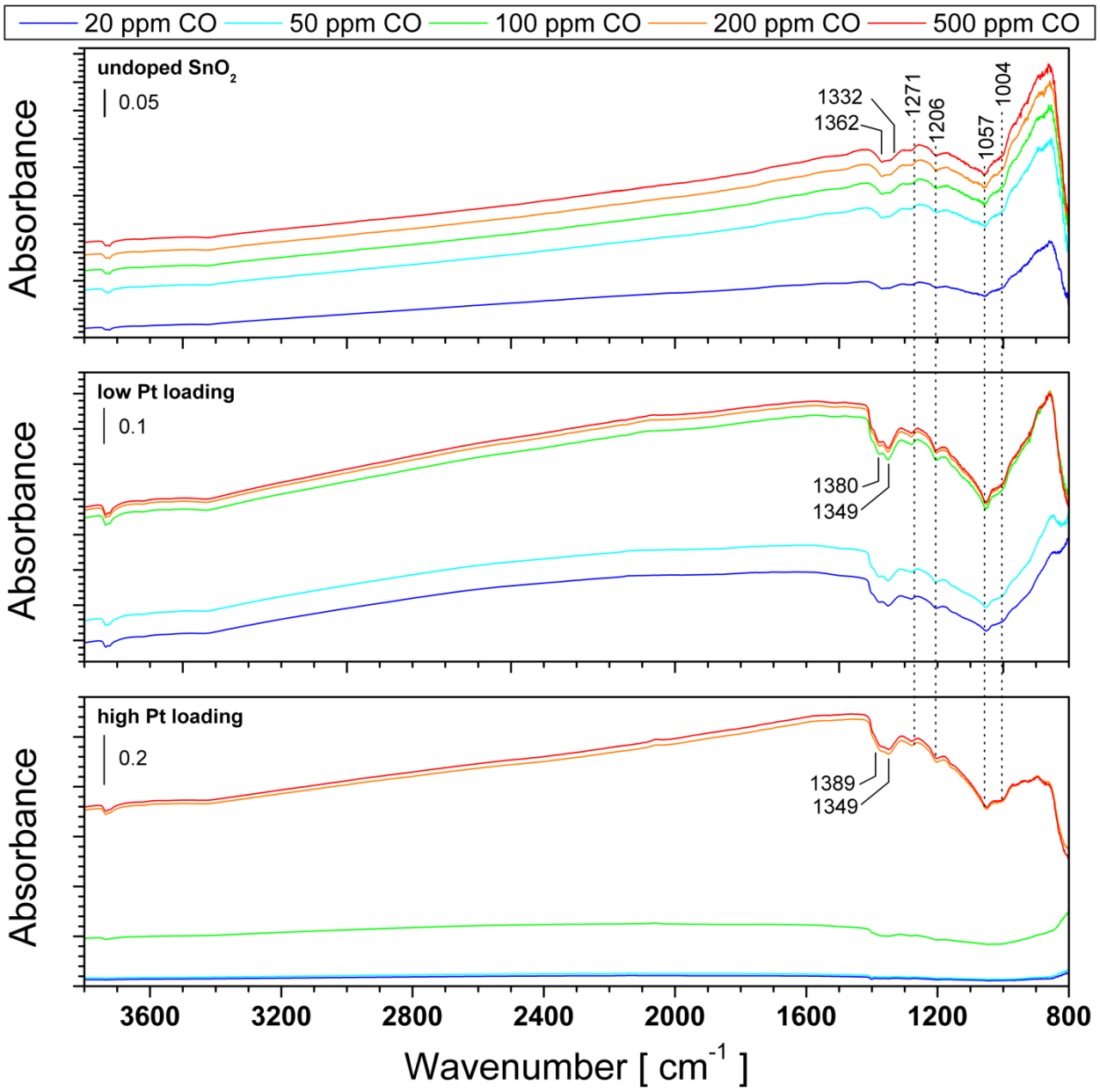

Figure S9. Full DRIFT spectra of undoped (top), LL (middle) and HL (bottom) sample recorded during CO exposure in low oxygen backgrounds.

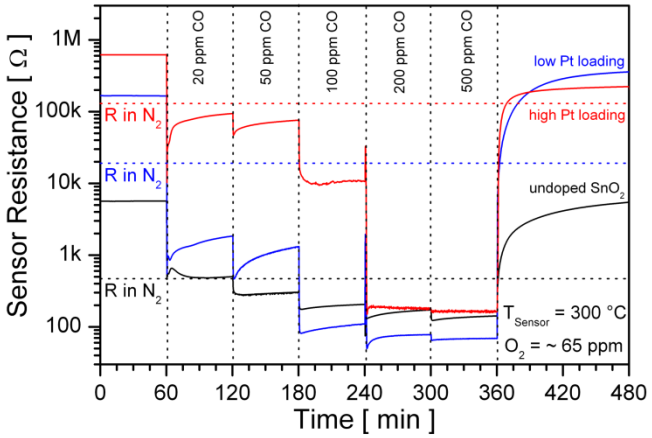

Figure S10. Resistance measurements of undoped (black), LL (blue) and HL (red) samples during DRIFTS in low oxygen backgrounds. The horizontal lines (R in N_2) show the sensor resistance in pure N_2.

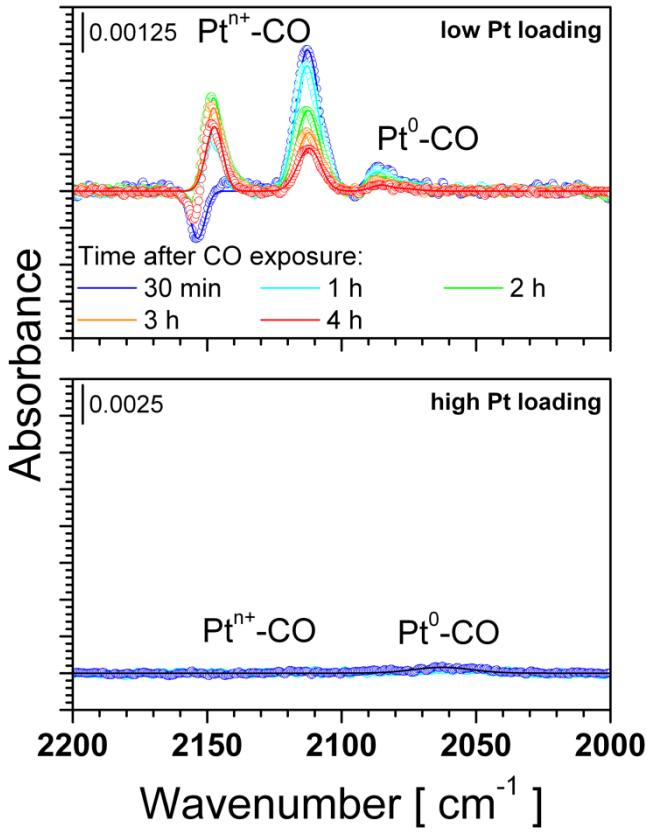

Figure S11. Baseline corrected DRIFT spectra of the LL (top) and HL (bottom) sample recorded after the CO exposure in low oxygen backgrounds. The spectra recorded during exposure are shown in the manuscript (Figure 7), the corresponding resistance measurements in Figure S10.