Supporting Information

Low-Temperature Pd/Zeolite Passive NOx Adsorbers: Structure, Performance and Adsorption Chemistry

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Content:

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S1

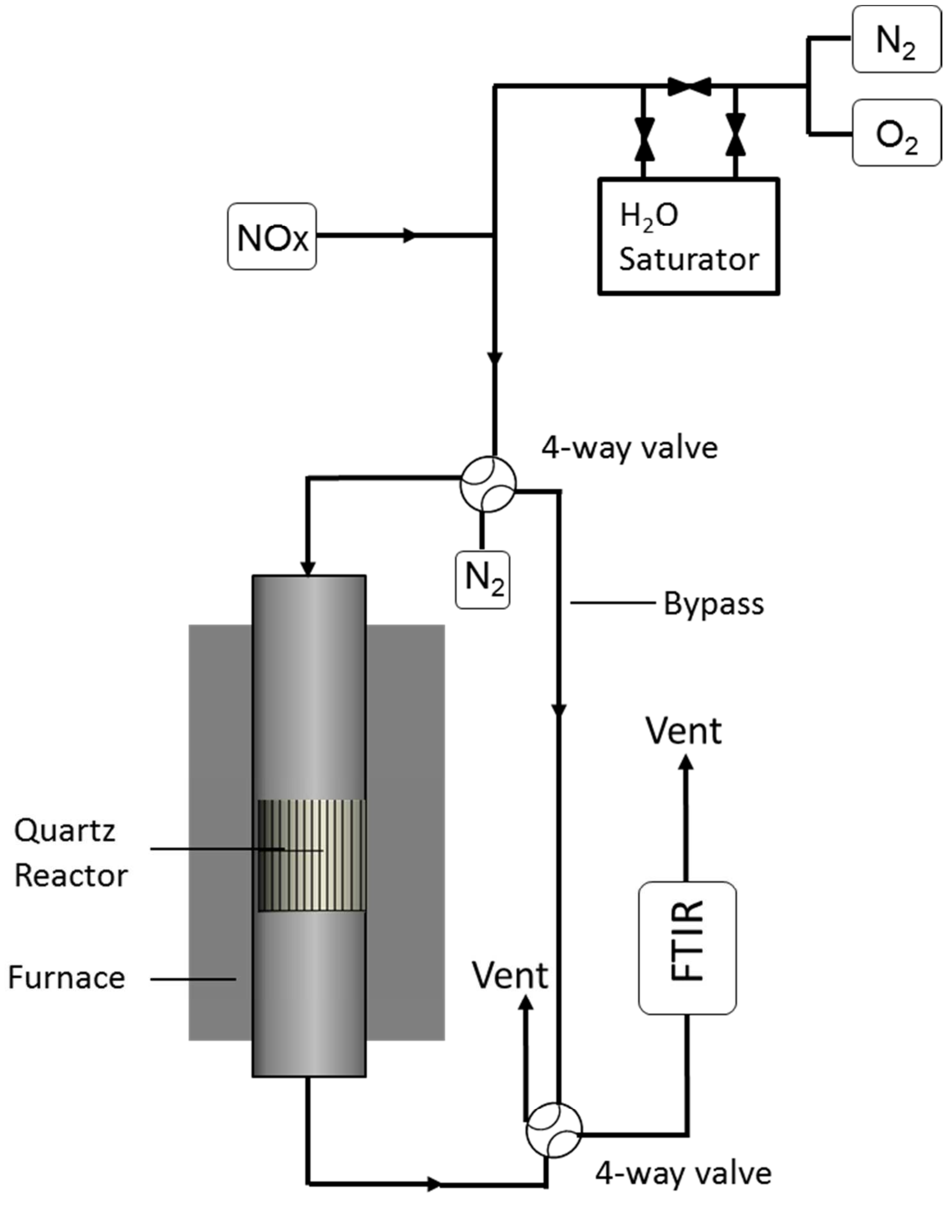
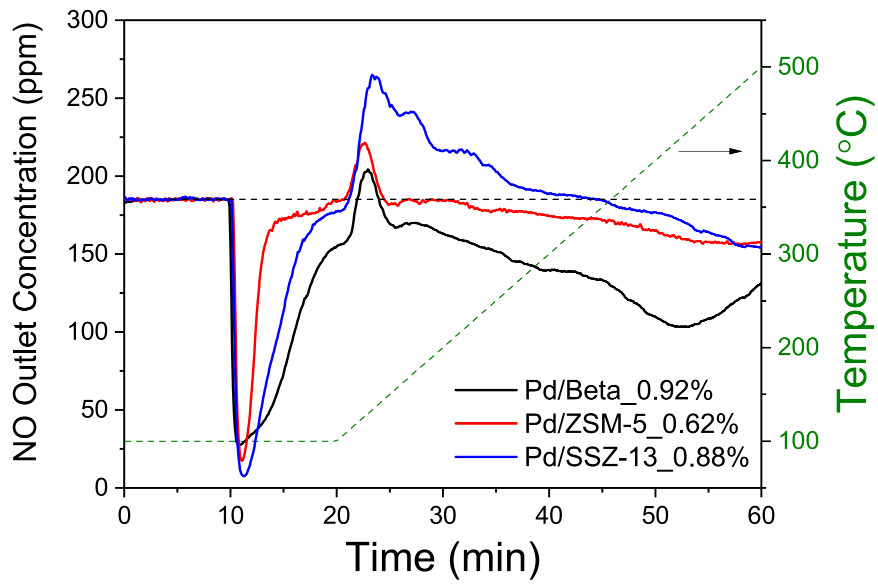
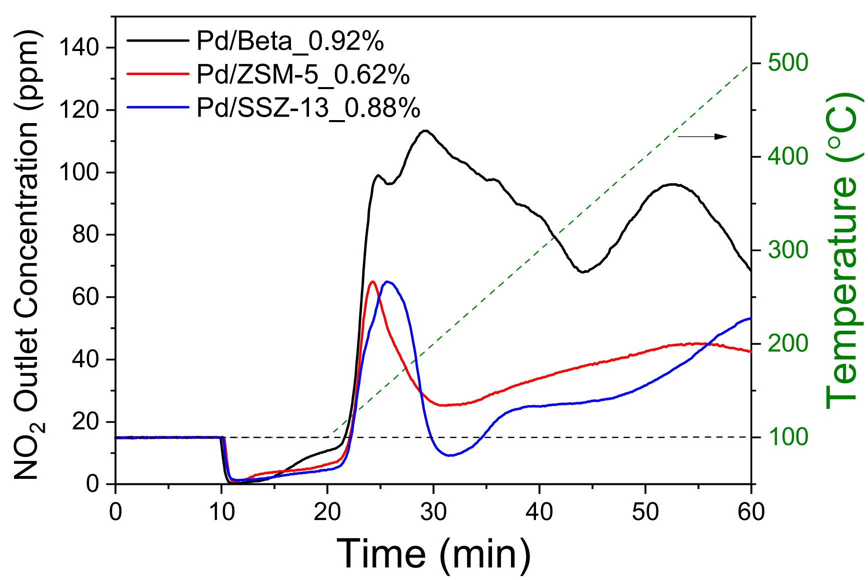


Figure S1: Schematic of the reactor and analyzer system.

S2



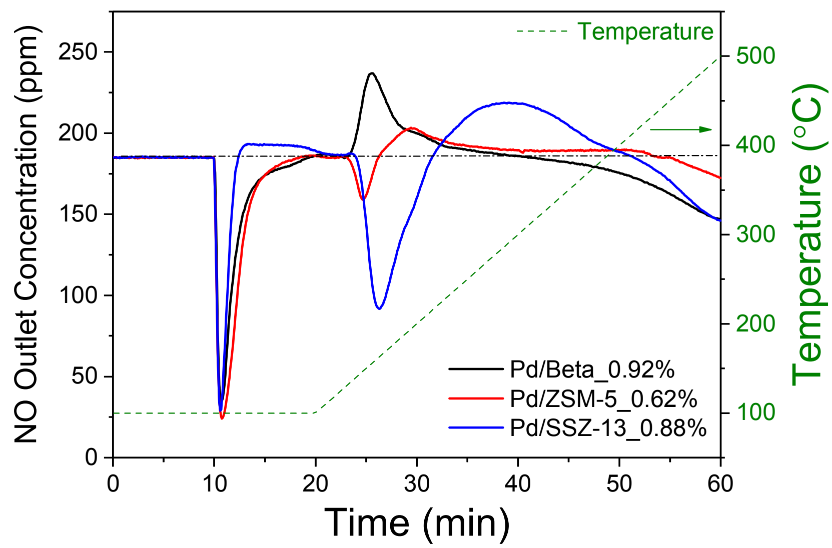
(a)



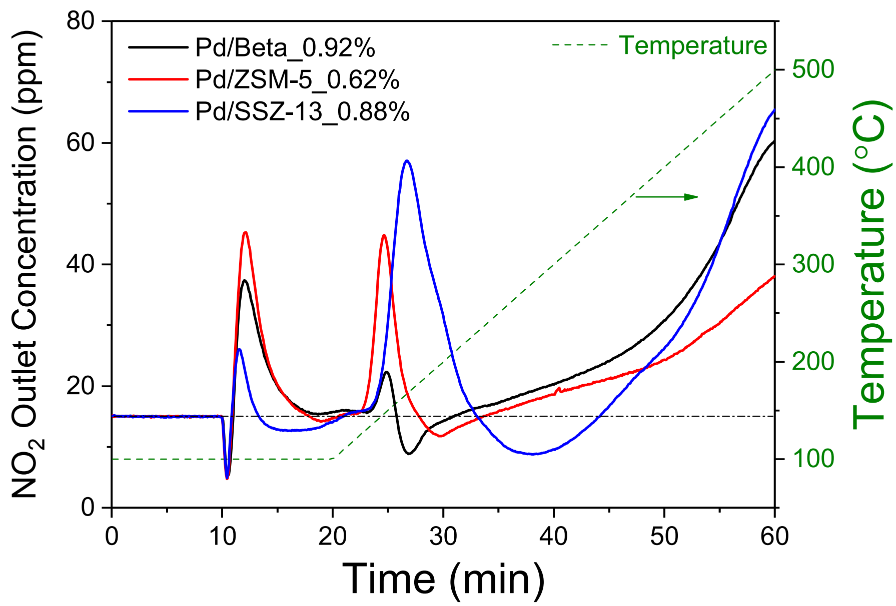
(b)

Fig. S2: NO (a) and NO_2 (b) adsorption and release profiles on the three Pd/zeolites in the absence of H_2O and CO in the feed. The corresponding total NOx profiles are shown in Fig. 1(a) of the main text.

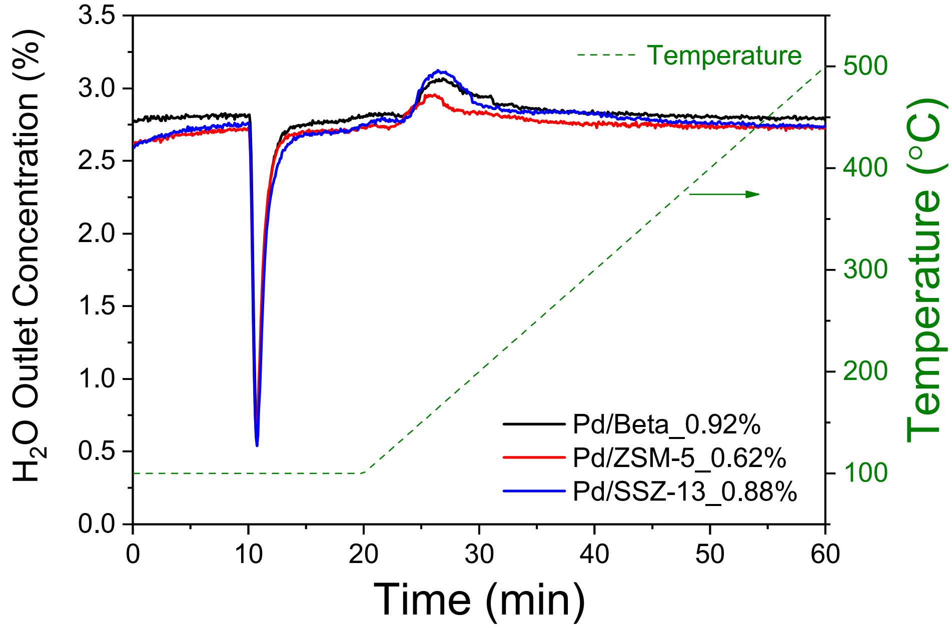
S3


Temperature
Pd/Beta_0.92%
Pd/ZSM-5_0.62%
Pd/SSZ-13_0.88%
NO Outlet Concentration (ppm)
Temperature (°C)
Time (min)

(a)


Pd/Beta_0.92%
Pd/ZSM-5_0.62%
Pd/SSZ-13_0.88%
Temperature
NO_2 Outlet Concentration (ppm)
Temperature (°C)
Time (min)

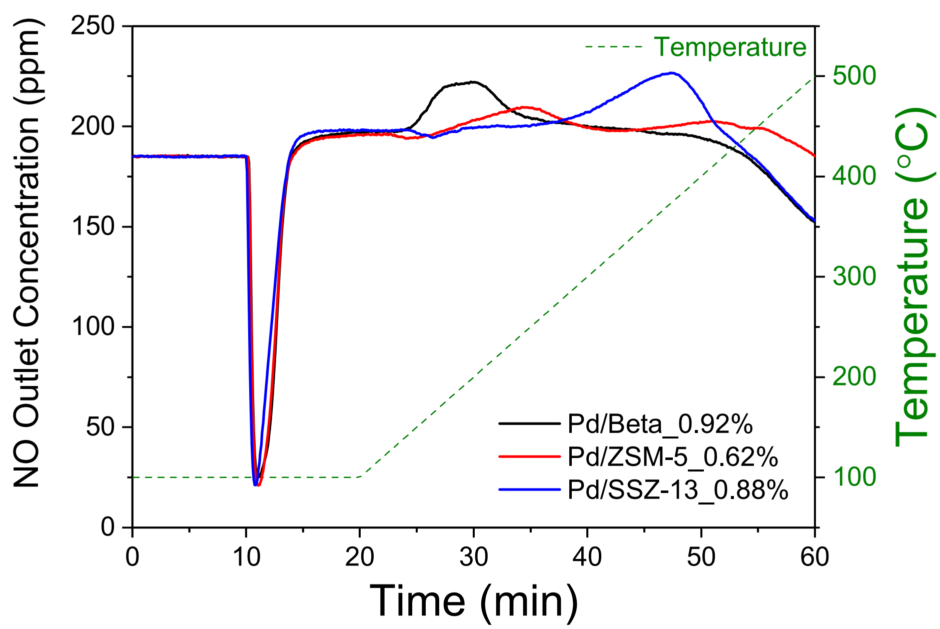
(b)



(c)

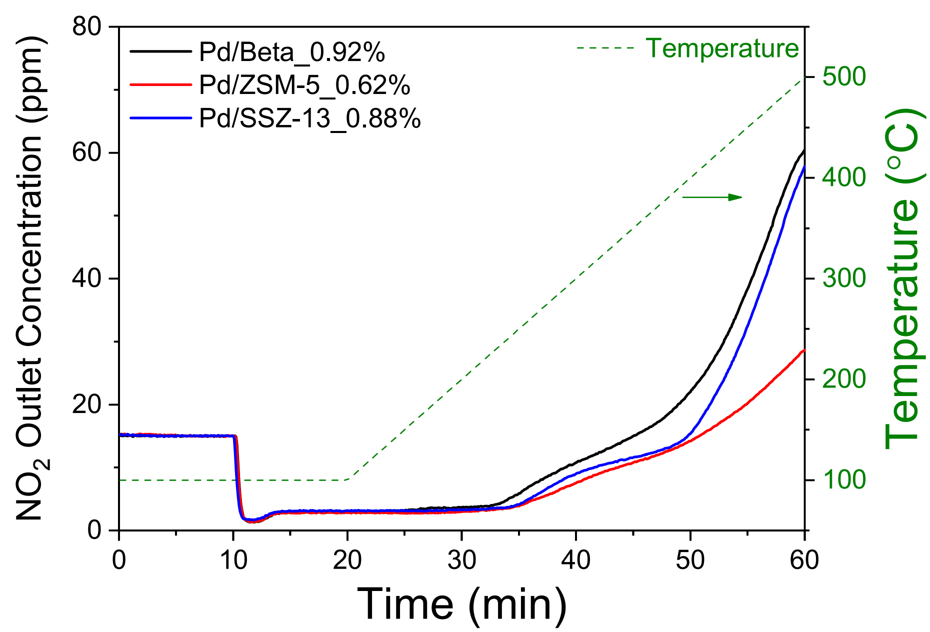
Fig. S3: NO (a), NO_2 (b) and H_2O (c) adsorption and release profiles on the three Pd/zeolites in the presence of H_2O but absence of CO in the feed. The corresponding total NOx profiles are shown in Fig. 1(b) of the main text.

S4



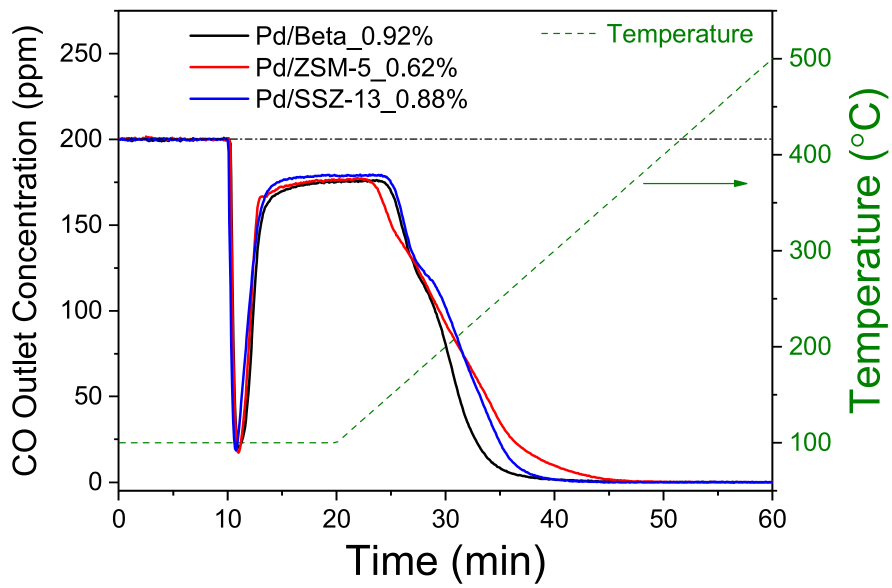
NO Outlet Concentration (ppm)
Temperature (°C)
Time (min)
Temperature
Pd/Beta_0.92%
Pd/ZSM-5_0.62%
Pd/SSZ-13_0.88%

(a)



NO$_2$ Outlet Concentration (ppm)
Temperature (°C)
Time (min)
Temperature
Pd/Beta_0.92%
Pd/ZSM-5_0.62%
Pd/SSZ-13_0.88%

(b)



(c)

Fig. S4: NO (a), NO_2 (b) and CO (c) adsorption and release profiles on the three Pd/zeolites in the presence of both H_2O and CO in the feed. The corresponding total NOx profiles are shown in Fig. 1(c) of the main text.

S5

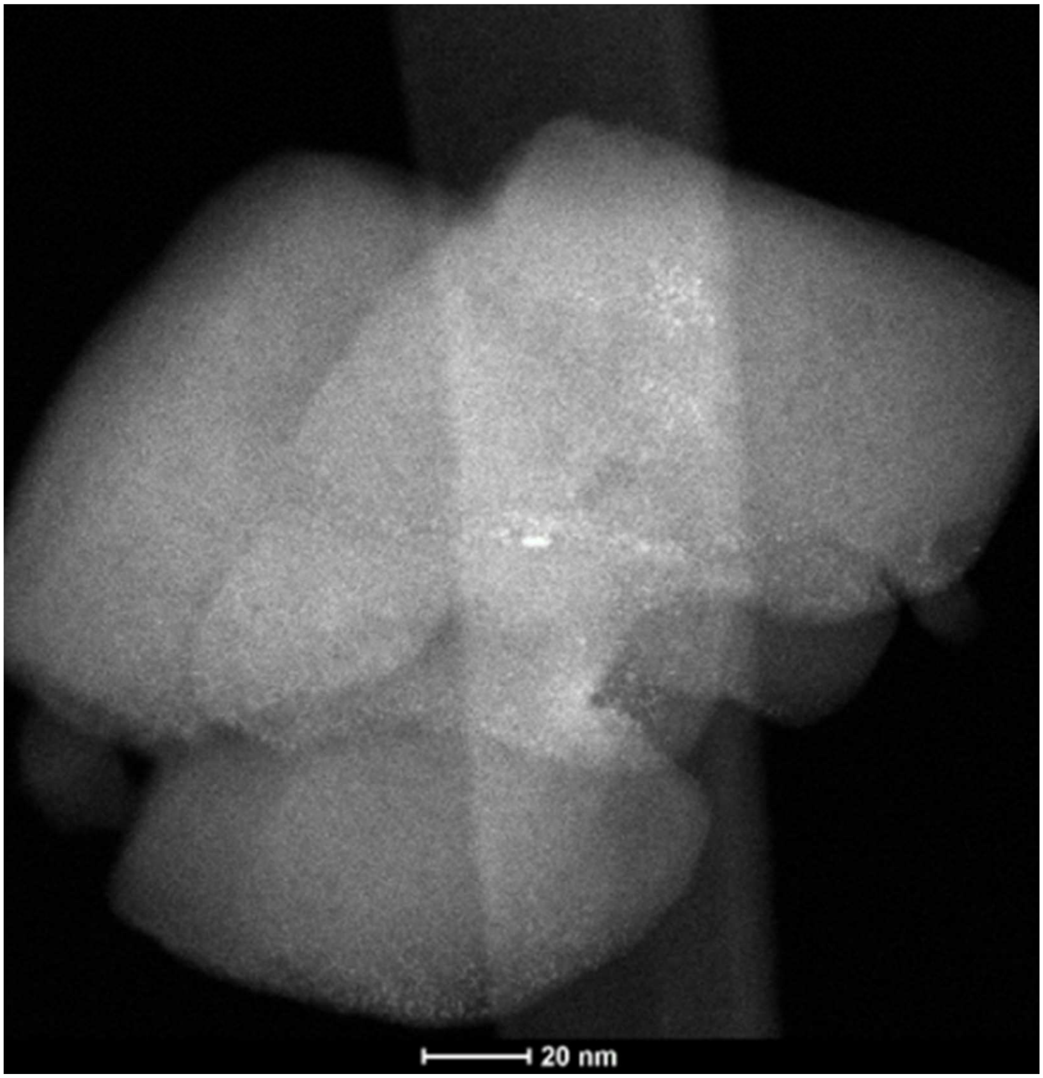


Fig. S5: STEM image of the fresh Pd/SSZ-13_0.88%. Note the presence of extremely finely dispersed PdOx clusters deposited on external surfaces.

S6

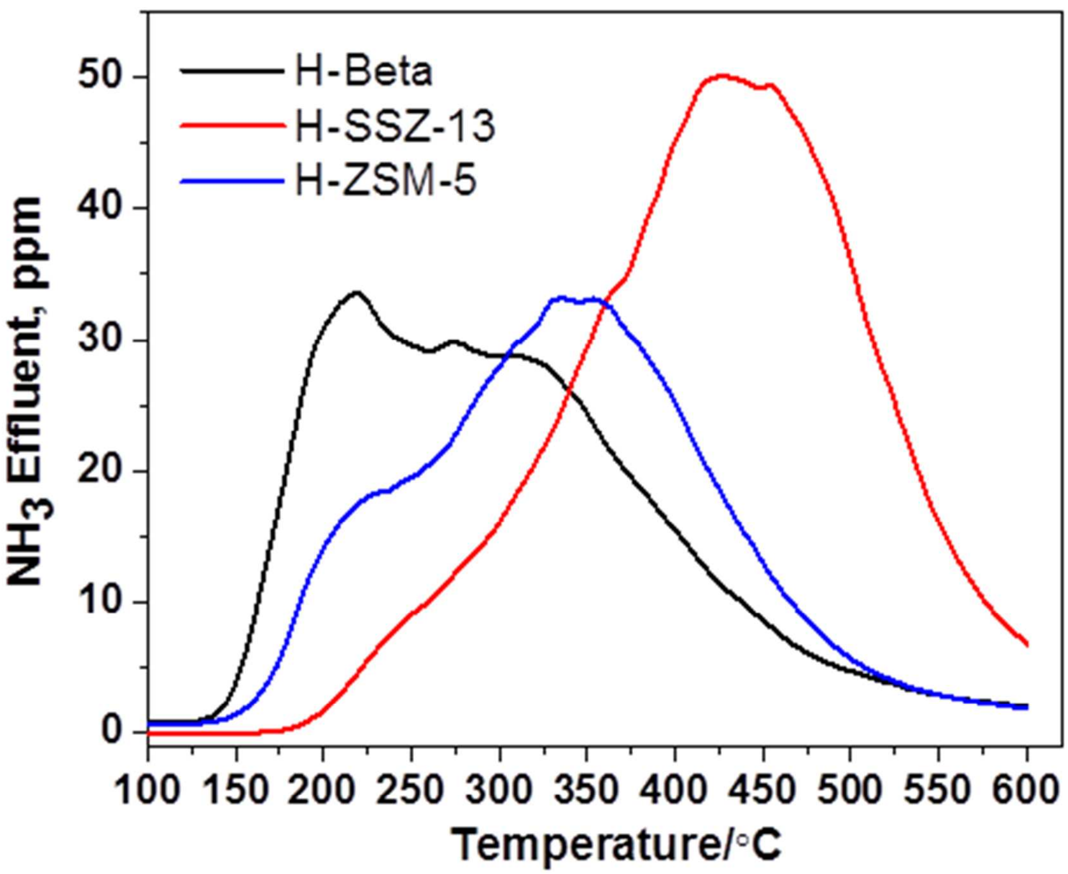


Fig. S6: Brønsted acidity (strength and site density) of the H/Beta, H/SSZ-13 and H/ZSM-5 materials probed with NH_3-TPD. NH_3 adsorption and purging are carried out at 100 °C. NH_3 desorption above ~300 °C can be attributed to desorption from Brønsted acid sites. These measurements clearly demonstrate that Brønsted acidity follows the trend that H/SSZ-13 > H/ZSM-5 > H/Beta.

S7

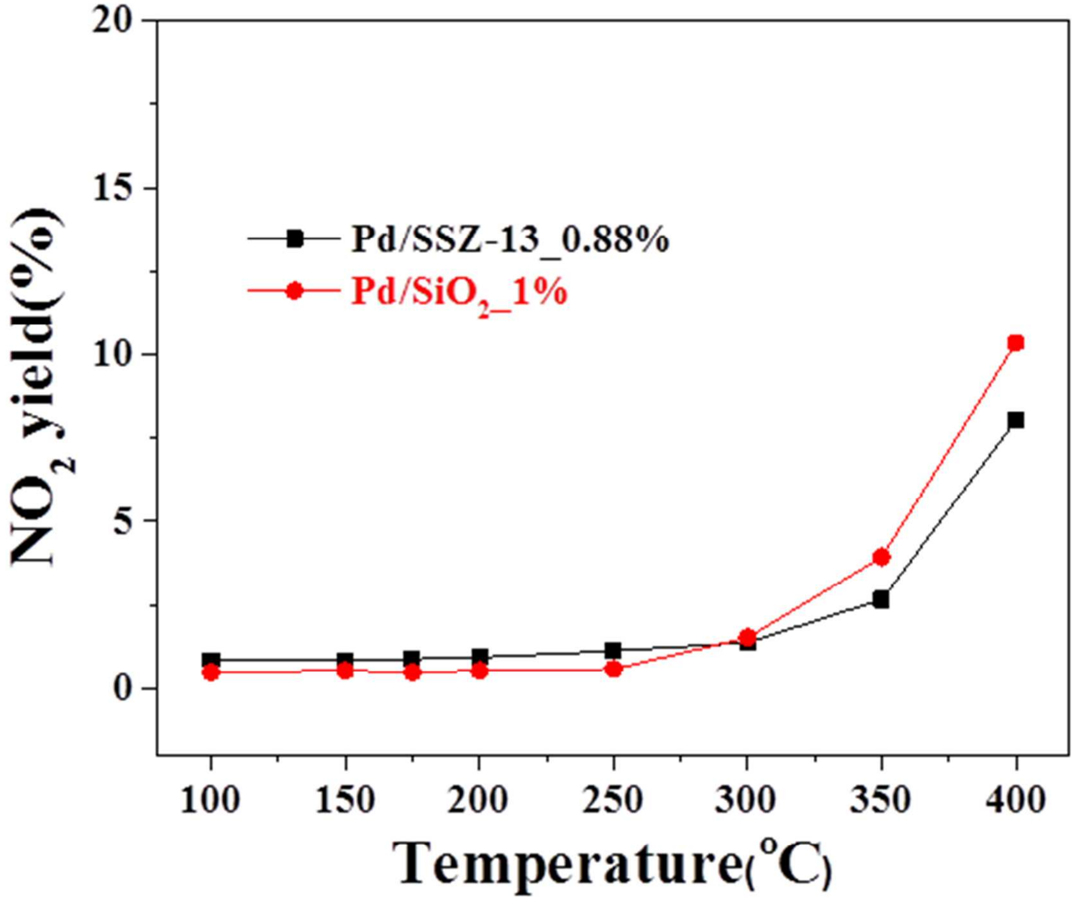


Fig. S7: Steady-state NO oxidation over Pd/SSZ-13_0.88% and Pd/SiO_2_1%. Note that below ~300 °C, NO_2 outlet concentrations are essentially identical to the background concentrations indicating that catalytic NO oxidation to NO_2 only occurs at temperatures higher than ~300 °C. This indicates that NO_2 formation at lower temperatures during NOx trapping originates from NO oxidation by PdOx.