Identifying Site-Dependent Reactivity in Oxidation Reactions on Single Pt Particles

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Supporting Information

Figure S1

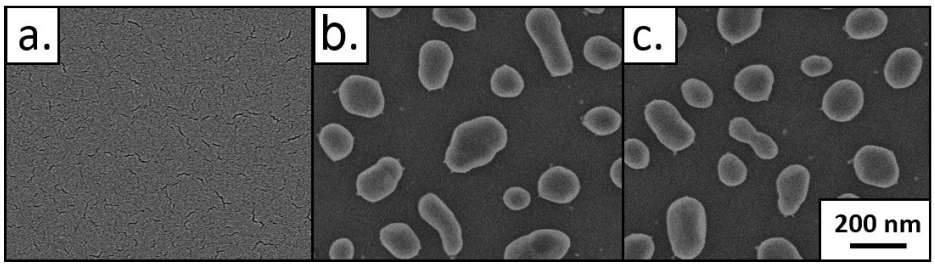

Figure S1. HR-SEM images of 20 nm Pt film on SiO_2/Si(110) before **(a)** and after **(b)** its annealing to 823 K for 5 h. HR-SEM image of NHCs-coated Pt particles after their exposure to liquid-phase oxidizing conditions (0.1% H_2O_2, 10 h) is shown in **(c)**.

Figure S2

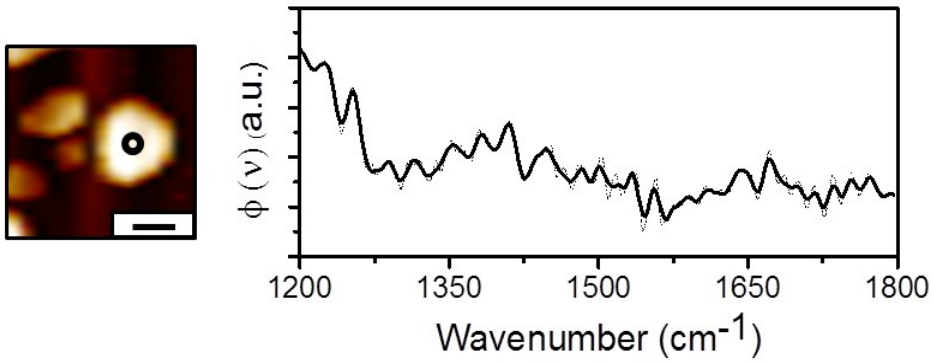

Figure S2. AFM topography and single point IR nanospectroscopy measurements of OH functionalized NHCs on the surface of single Pt particle. The measurements were conducted at the center of the particle (the position of the IR measurement is marked by a colored circle) that was exposed to gas phase oxidizing conditions (1 atm O_2, 80°C, 10 h) and subsequently exposed to reducing conditions (1 atm H_2, 80°C, 10 h). Scale bar represents 100 nm.

Figure S3

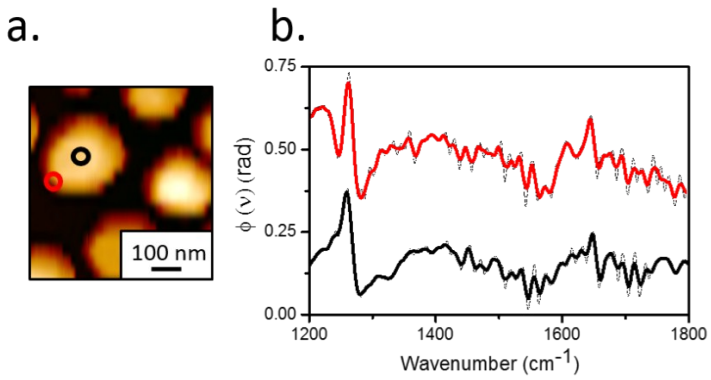

Figure S3. IR nanospectroscopy measurements were conducted at the side (marked by red circle in **a** and the corresponding red spectrum in **b**) and center (marked by black circle in **a** and the corresponding black spectrum in **b**) of Pt particle which was coated with OH-functionalized NHCs and exposed to 0.1% H_2O_2. The two measurements show similar pattern, with distinguishable absorption at 1250 and 1550-1700 cm^{-1}.

Figure S4

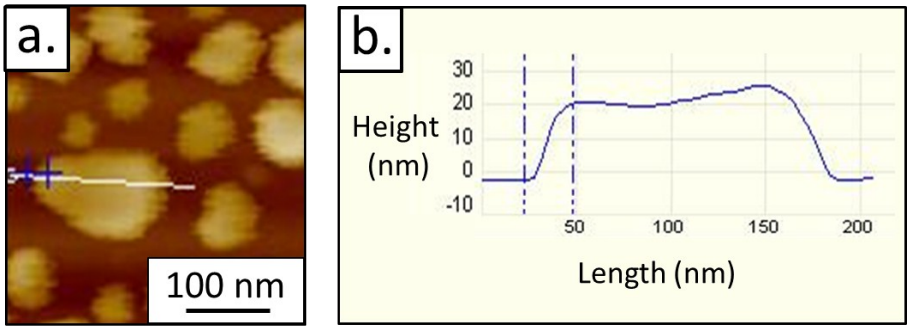

Fig. S4: a. AFM topography image of NHCs-coated Pt particles on Si surface. **b.** Cross section analysis of one particle. The path of the line scan along the sample is marked by white line in the AFM image (**a.**). The length of the particle's profile is ~20 nm and its location is marked by dash lines in **b** and blue crosses in **a.**

Figure S5

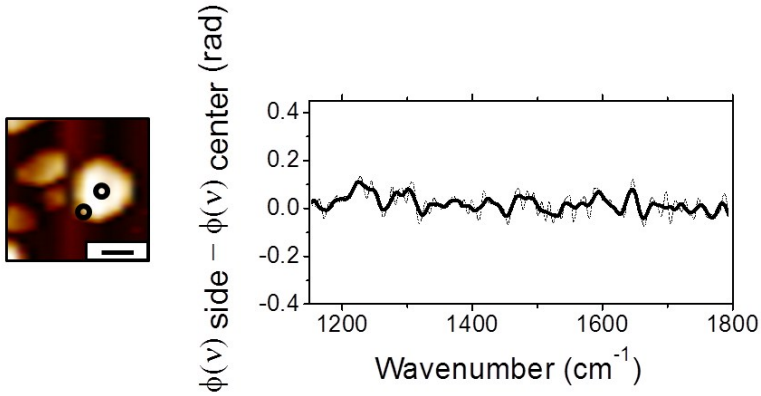

Figure S5. Infrared nanospectroscopy measurements were conducted on the edge and center of a single Pt particle (the position of IR measurements is marked by colored circles in the AFM image) after exposure of the sample to reducing conditions of 1 atm H_2 at 80˚C. Scale bar represents 100 nm.

Figure S6

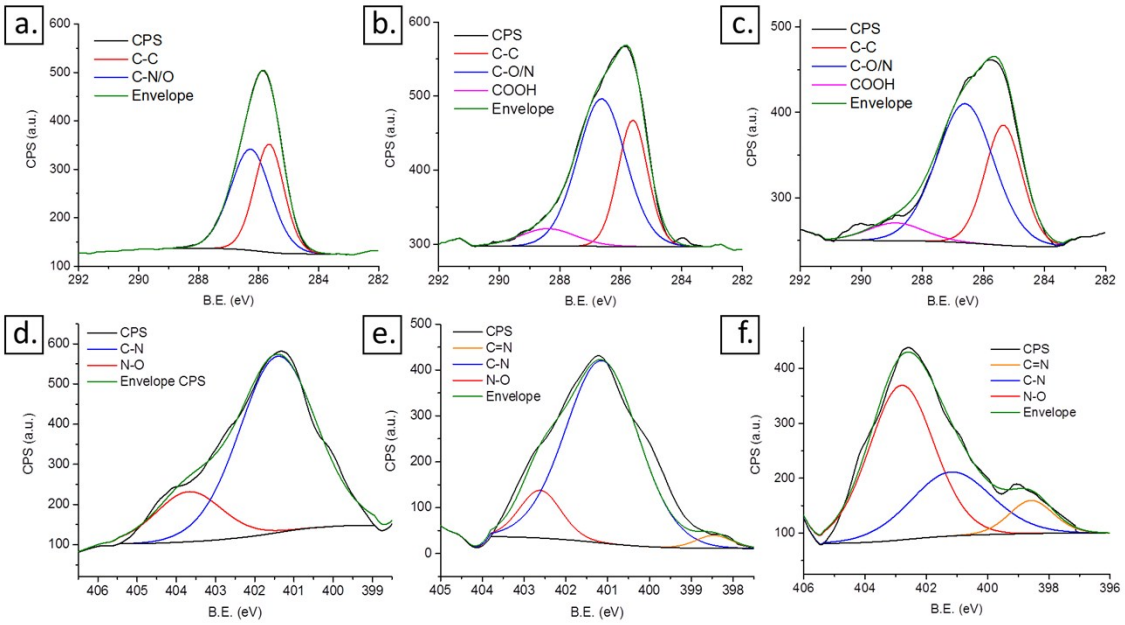

Figure S6. C1s (a-c) and N1s (d-f) XP-spectra taken before (a and d) and after exposure of the sample to gas phase (1 atm O_2, 80 °C, 10 h) (b and e) and liquid phase (0.1% w/w H_2O_2, rt, 10 h) (c and f) oxidizing conditions. The measured XPS peak and Gaussian fitting of the deconvoluted components are shown.

Figure S7

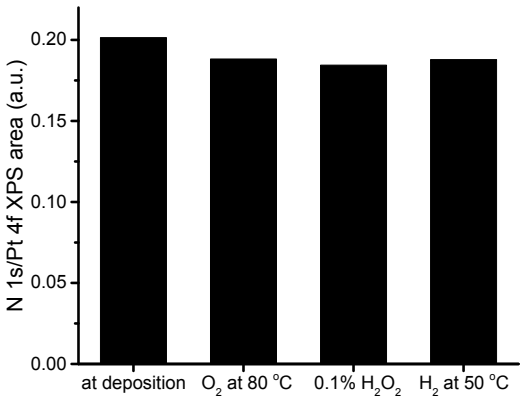

Figure S7. Analysis of the area ratio of N 1s/Pt 4f XPS signals before and after exposure of the NHCs-coated Pt particle to various oxidizing and reducing conditions.