

Supplementary

Oxidative Cleavage of 9,10-Dihydroxystearic Acid on Supported Au, Pd and PdAu Nanoparticle-Based Catalysts

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Detailed description of the methods used to characterize the supports and corresponding catalysts.

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Figure S1. Deconvoluted XPS spectra of Au4f for: Au/AlOOH_C; Au/AlOOH_S5; Au/La₂O₃/TiO₂; Au/CeO₂/TiO₂; Au/Cp-NH₄OH; PdAu/Cp-NH₄OH.

Figure S2. Deconvoluted XPS spectra of Pd3d for: Pd/Cp-NH₄OH and PdAu/Cp-NH₄OH.

Figure S3. XRD patterns for supports and corresponding catalysts.

Figure S4. TEM images and corresponding histograms for: Au/AlOOH_C; Au/AlOOH_S5; Au/La₂O₃/TiO₂; Au/CeO₂/TiO₂; Pd/Cp-NH₄OH; Au/Cp-NH₄OH; PdAu/Cp-NH₄OH.

1. Description of the used methods of characterization

Palladium and gold contents were measured by inductively coupled plasma atomic emission spectroscopy (AES ICP) in an iCAP 6300 Duo spectrometer (Thermo Fisher Scientific, Waltham, MA, USA) and X-ray energy dispersive spectroscopy (XEDS) in a JEOL JEM-2100F electronic microscope (JEOL Ltd., Tokyo, Japan) equipped with an Oxford INCA X-sight system detector (Oxford Instruments, Abingdon, Oxfordshire, UK).

XRD patterns were recorded using a Philips XPert PRO diffractometer for TiO₂ samples (Amsterdam, Netherlands) and Bruker D8 X-ray diffractometer (Bruker Corporation, Billerica, MA, USA) for sunit and AlOOH samples. For both diffractometers were using CuK α as X-ray source ($\lambda = 0.15406$ nm) and scanning range of $2\theta = 10\text{--}90^\circ$.

Textural properties were studied using an ASAP 2060 (Micromeritics Instrument Corporation, Norcross, GA, USA) apparatus. Catalysts were previously degassed in vacuum at 300 °C for 5 h. The surface area and pore size distribution were calculated using the Brunauer-Emmett-Teller (BET) equation applied for the adsorption isotherm at the relative pressures between 0.005 to 0.25 and Barrett-Joyner-Halenda (BJH) method (desorption branch), respectively.

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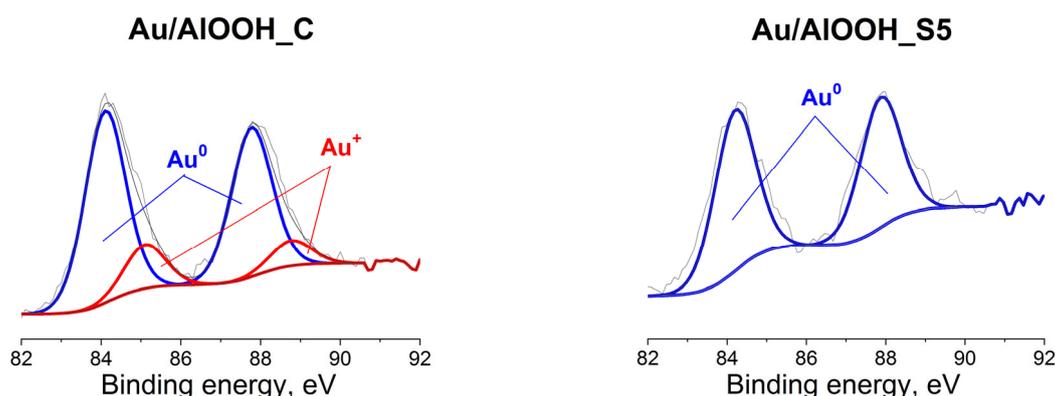
Size distribution of Pd and Au nanoparticles was studied by high resolution transmission electron microscopy (HRTEM) using a JEOL JEM-2100F (JEOL Ltd., Tokyo, Japan) with a sample preparation system. The samples were dispersed to a fine powder and sonicated in ethanol at room temperature. Derived suspension was applied on a carbon-coated Cu grid. For each sample, at least 700 particles were counted.

The chemical state of Pd and Au on carbon and alumina materials were determined by X-ray photoelectron spectroscopy (XPS) analysis, performed on an ESCALAB 200A spectrometer (VG Scientific, Waltham, MA, USA) using Al K α radiation (1486.6 eV). A pass-energy of 40 eV and a step size of 0.1 eV were selected. The charge effect was corrected using the C1s peak as a reference (binding energy of 248.8 eV).

Electronic state of gold deposited on modified-TiO₂ samples were investigated by X-ray photoelectron spectroscopy (XPS) with a SPECS GmbH custom (SPECS Surface Nano Analysis GmbH, Berlin, Germany) made system using a PHOIBOS 150 WAL hemispherical analyzer and a non-monochromated X-Ray source. All the data were acquired using Al K α X-rays (1486.6 eV, 200 W). A pass-energy of 50 eV, a step size of 0.1 eV, and a high-intensity lens mode were selected. The diameter of the analyzed area was 3 mm. Charging shifts were referenced against adventitious carbon. The pressure in the analysis chamber was maintained lower than 1-10⁻⁸ mbar. Catalysts were mounted on a sample holder and kept overnight in high vacuum in the preparation chamber before they were transferred to the analysis chamber of the spectrometer. Energy regions were selected after a general survey and scanned with several sweeps until a good signal-to-noise ratio was observed. The accuracy of the binding energy (BE) values was ± 0.1 eV. Spectra are presented without smoothing or background subtraction, with intensity in counts-per-second (CPS). Peak intensities were estimated by calculating the integral of each peak after subtracting a Shirley type background and fitting the experimental peak to a combination of Lorentzian/Gaussian lines with a 30/70 proportion, considering the spin-orbit 4f_{7/2} and 4f_{5/2} doublet with a 4:3 intensity ratio and the same width on all lines.

The CASA XPS software (version 2.3.15, CASA Software Ltd., Teignmouth, UK, <http://www.casaxps.com/>) was used for data analysis.

2. Figures



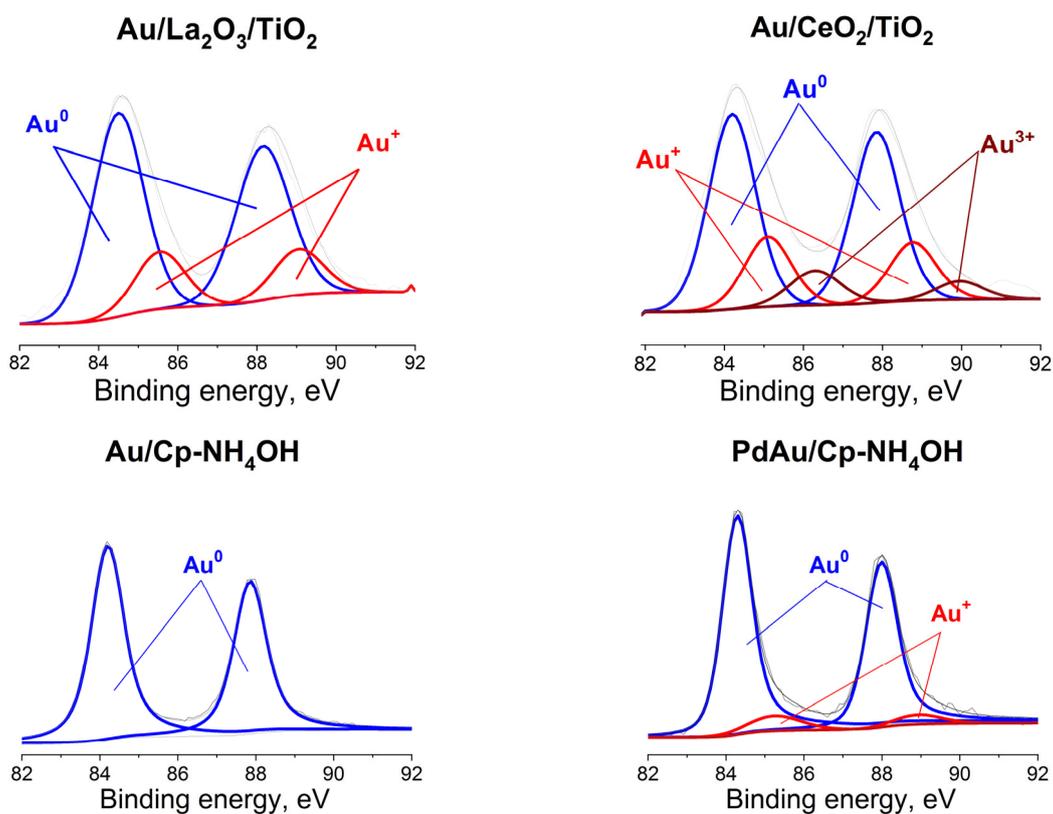


Figure S1. Deconvoluted XPS spectra of Au4f for: Au/AlOOH_C; Au/AlOOH_S5; Au/La₂O₃/TiO₂; Au/CeO₂/TiO₂; Au/Cp-NH₄OH; PdAu/Cp-NH₄OH.

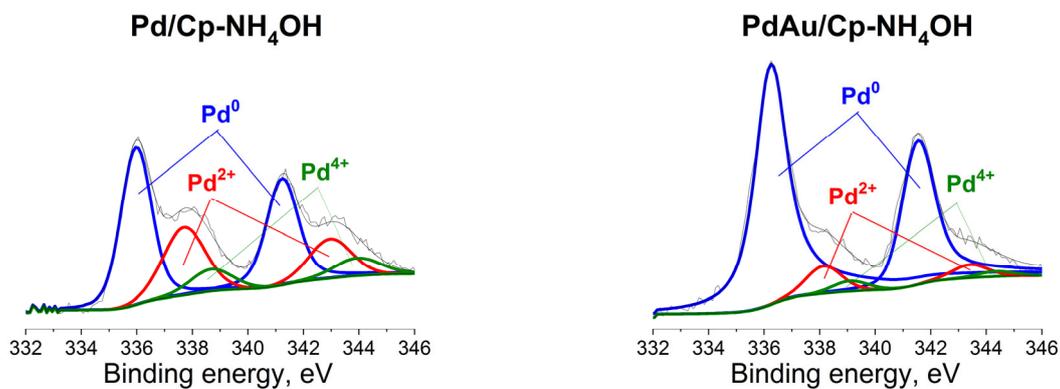


Figure S2. Deconvoluted XPS spectra of Pd3d for: Pd/Cp-NH₄OH and PdAu/Cp-NH₄OH.

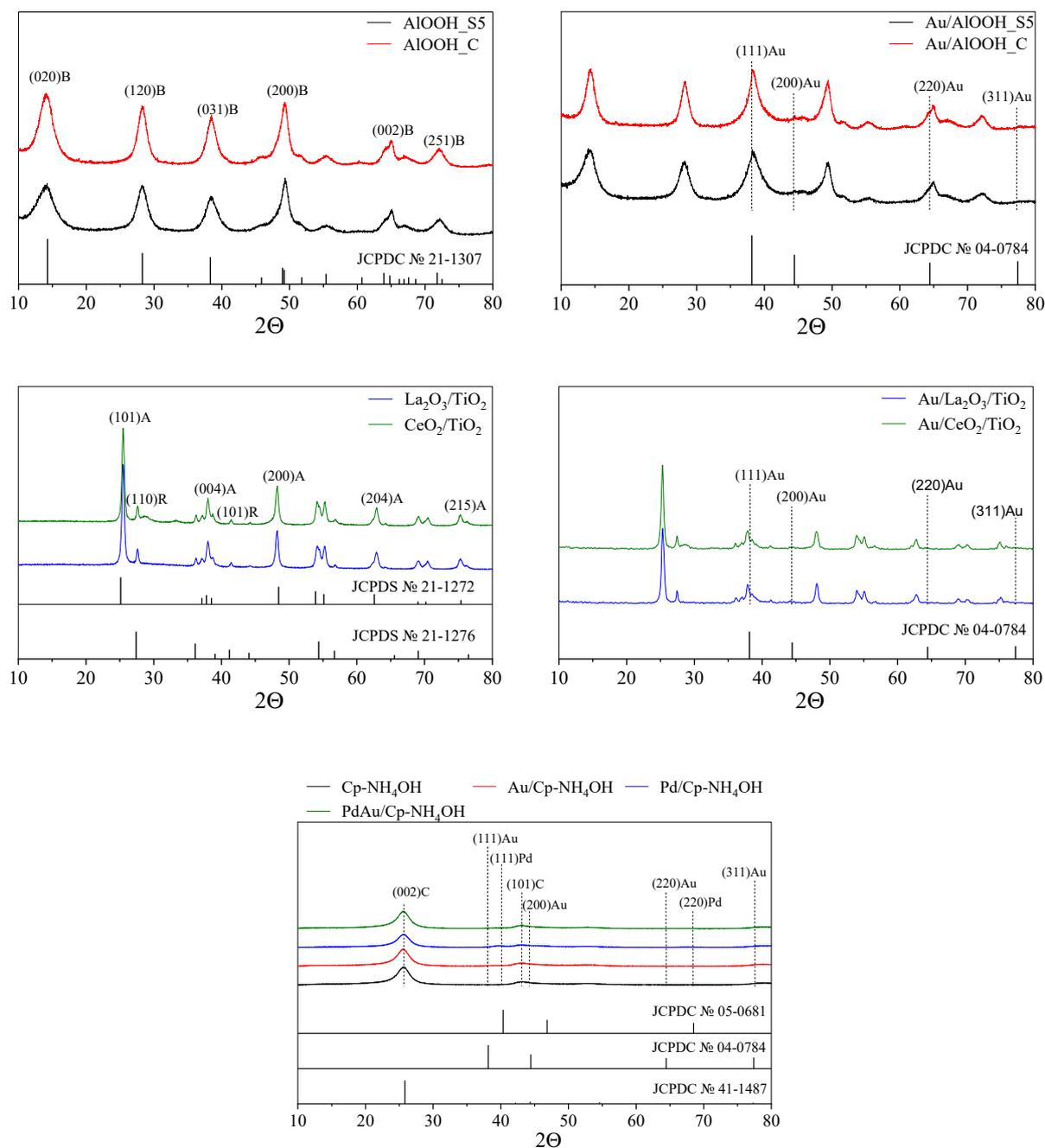
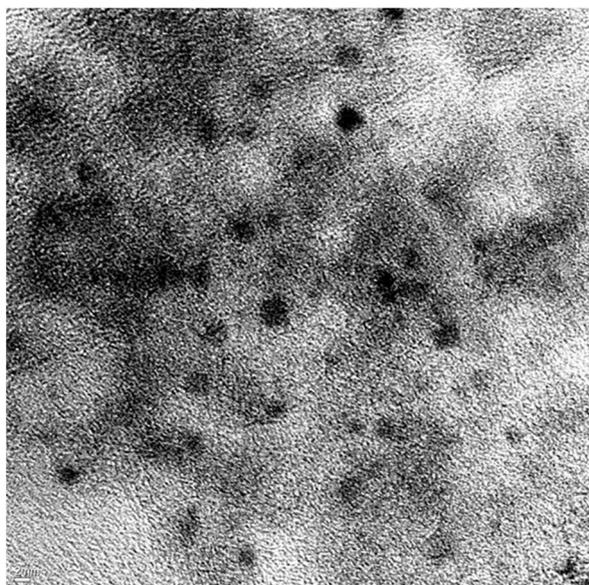
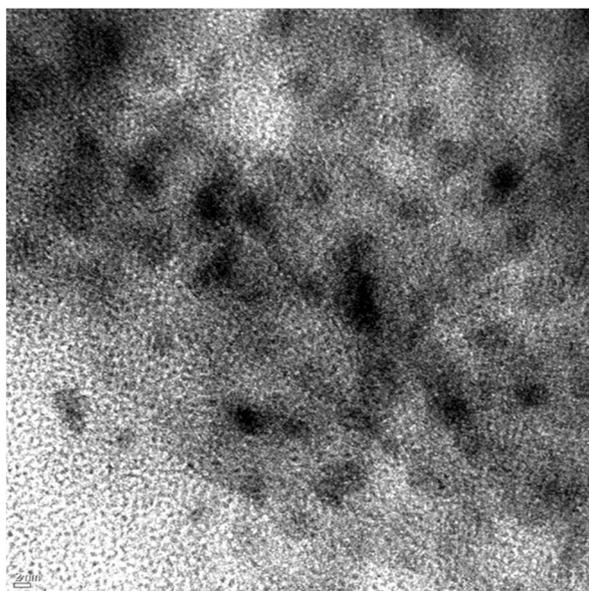
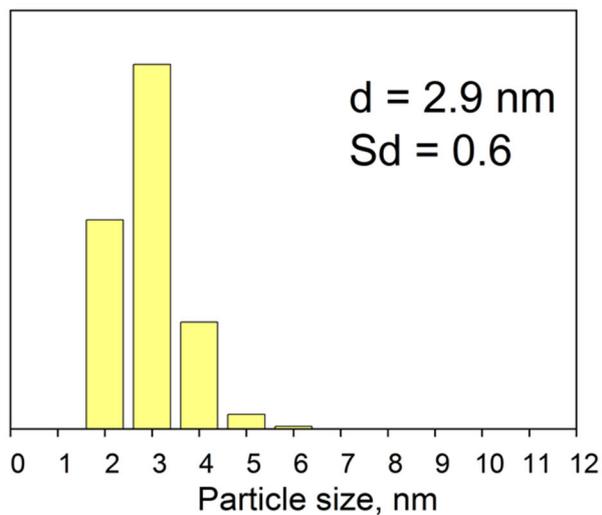


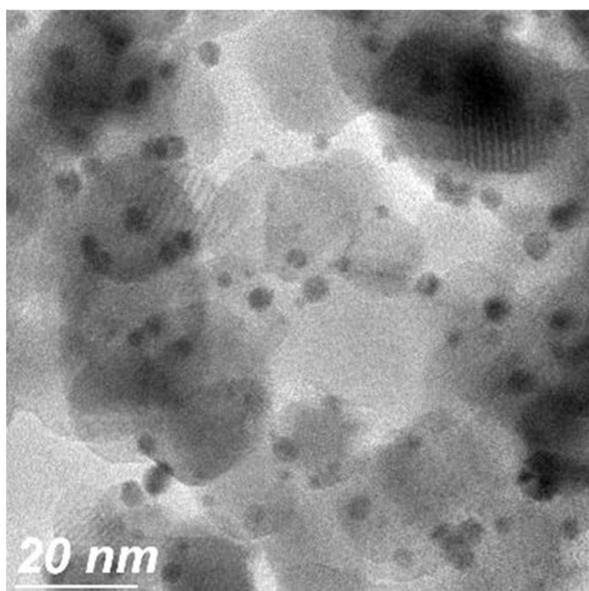
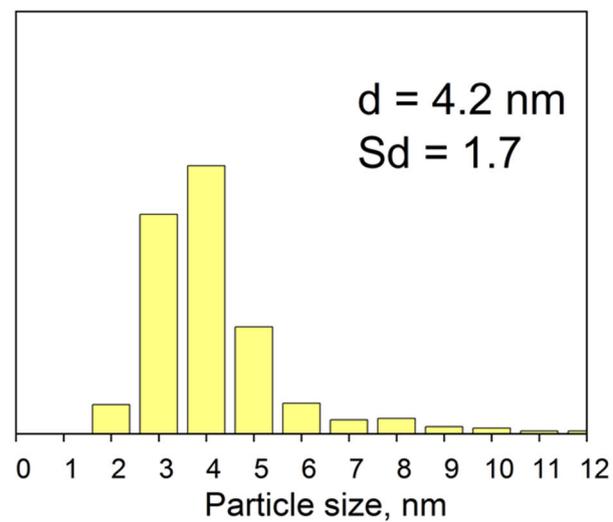
Figure S3. XRD patterns for supports and corresponding catalysts, JCPDS card number: 21-1307 (boehmite); 04-0784 (gold); 21-1272 (TiO₂ – anatase); 21-1276 (TiO₂ – rutile); 41-1487 (graphite) and 05-0681 (palladium).



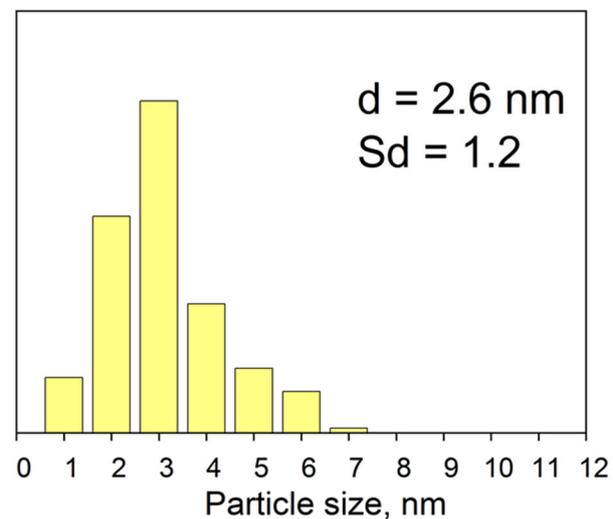
Au/AIOOH_C

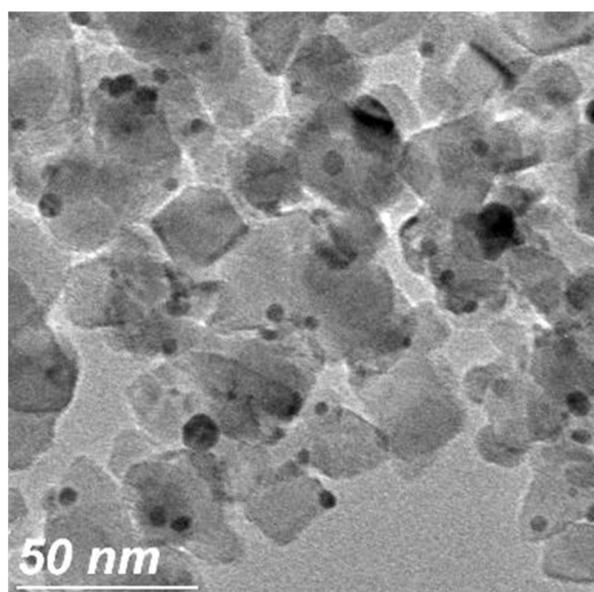
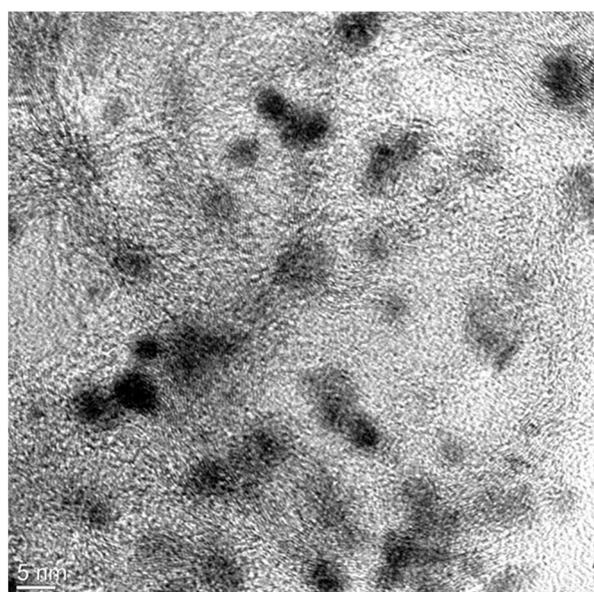
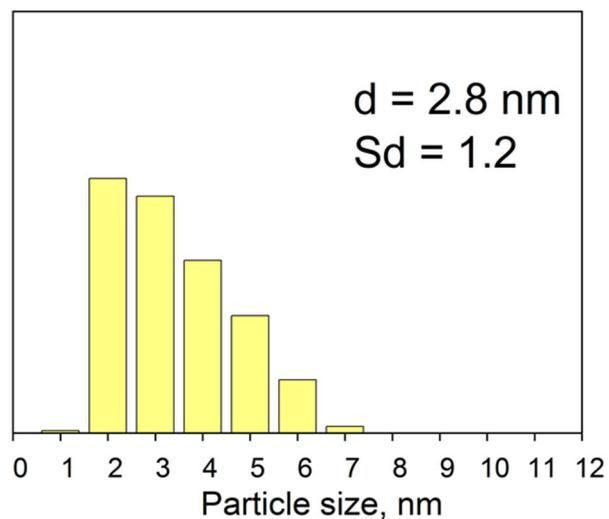
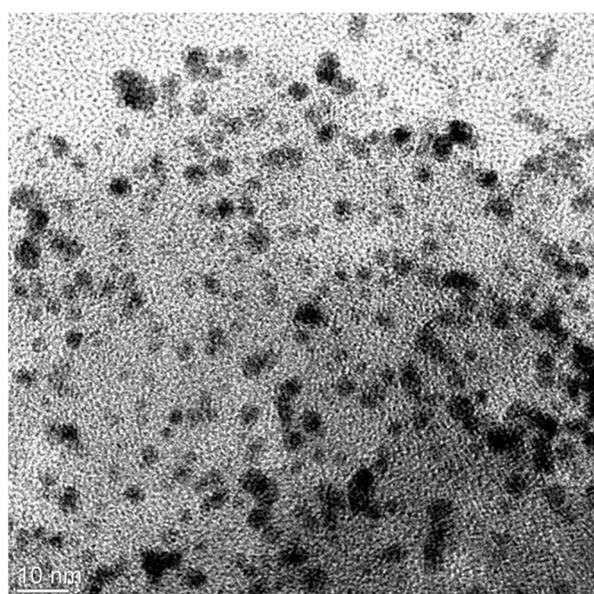
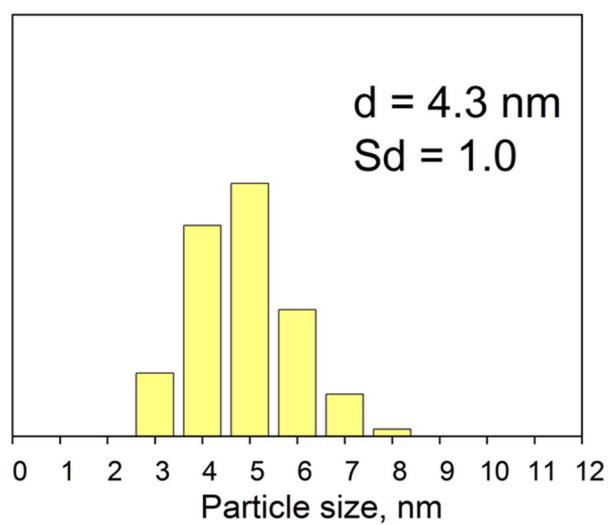
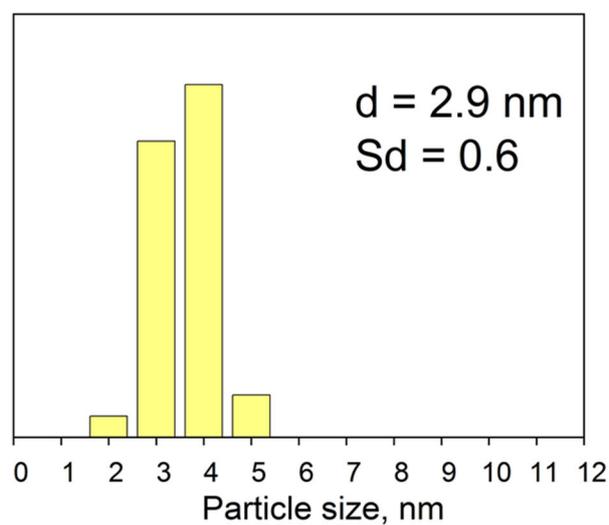


Au/AIOOH_S5



Au/La₂O₃/TiO₂



**Au/CeO₂/TiO₂****Pd/Cp-NH₄OH****Au/Cp-NH₄OH**

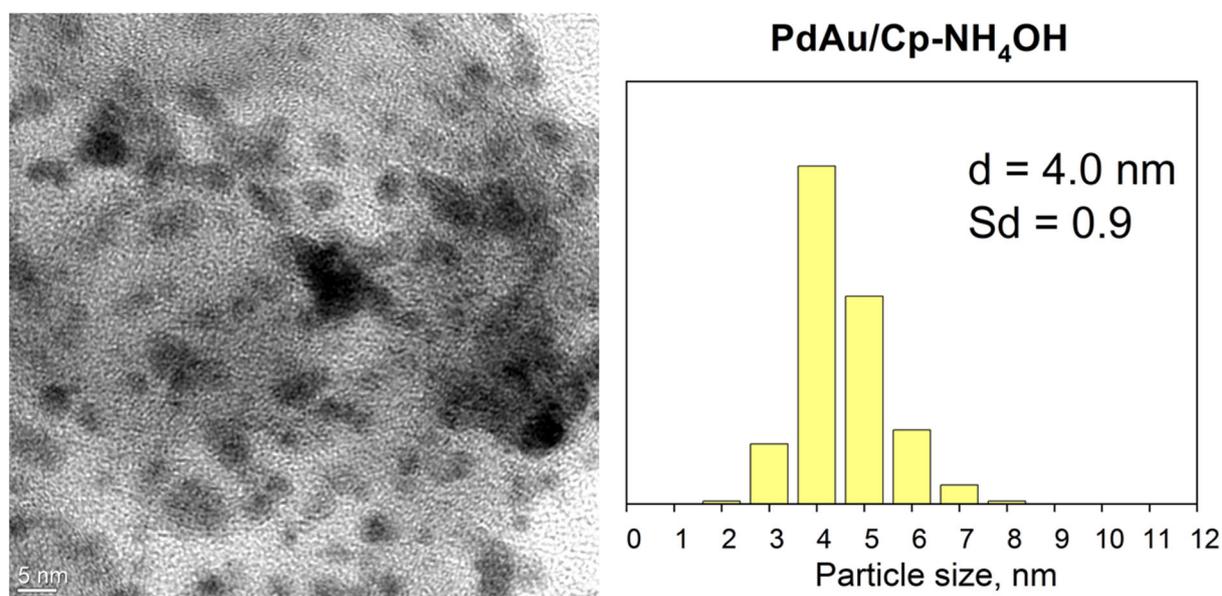


Figure S4. TEM images and corresponding histograms for Au/AlOOH_C; Au/AlOOH_S5; Au/La₂O₃/TiO₂; Au/CeO₂/TiO₂; Pd/Cp-NH₄OH; Au/Cp-NH₄OH; PdAu/Cp-NH₄OH.

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