Supporting Information

A versatile sol-gel coating for mixed oxides on nanoporous gold and their application in the water gas shift reaction

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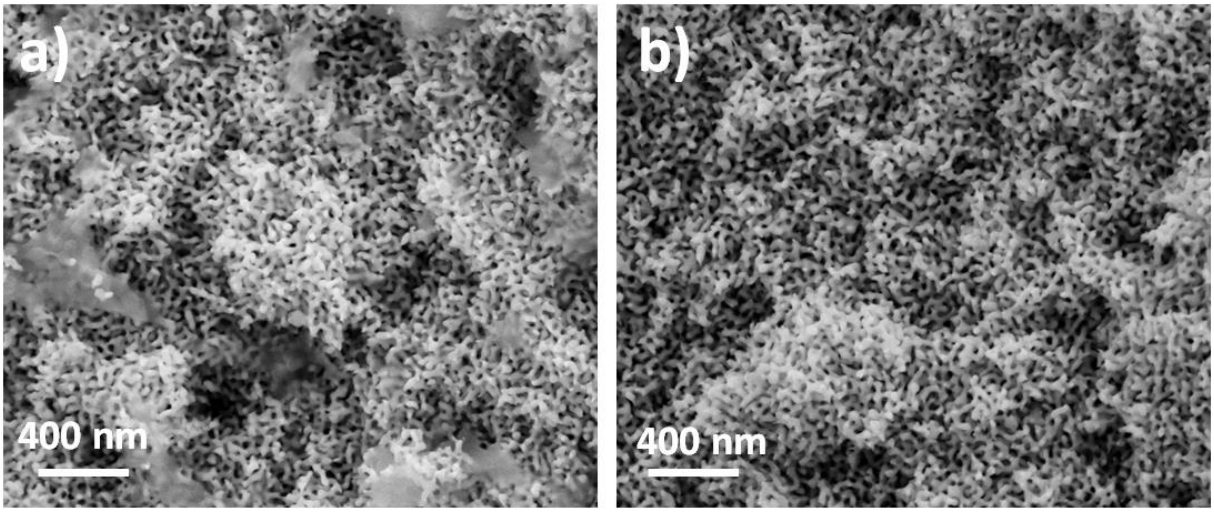

Figure S1: SEM characterization of titania modified nanoporous gold (TiO_2/npAu). a) before annealing b) after annealing at 450° C for 2h.

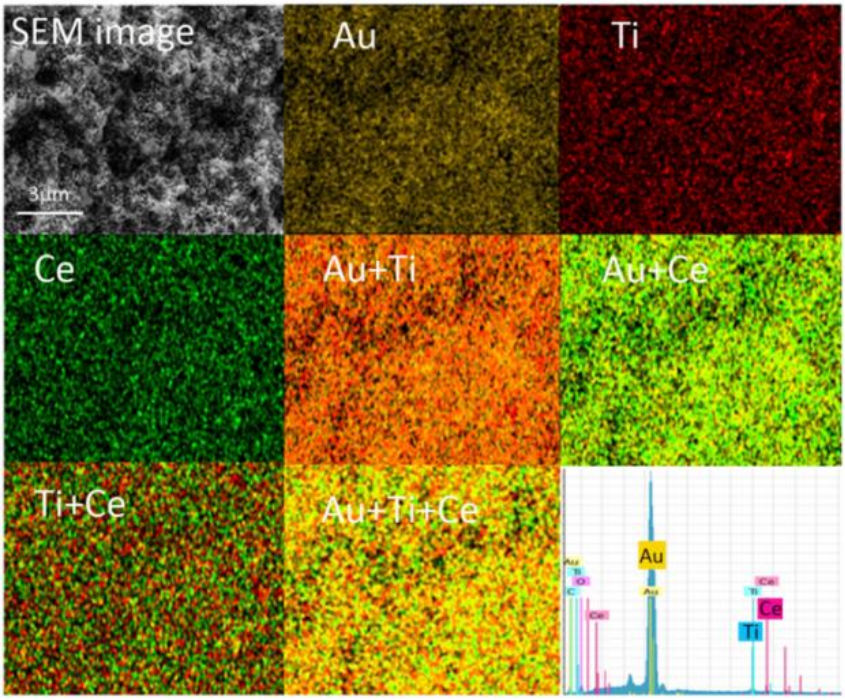

Figure S2: EDX elemental mapping images of Ti-CeO_x mixed oxides modified npAu after annealing at 450°C for 2h.

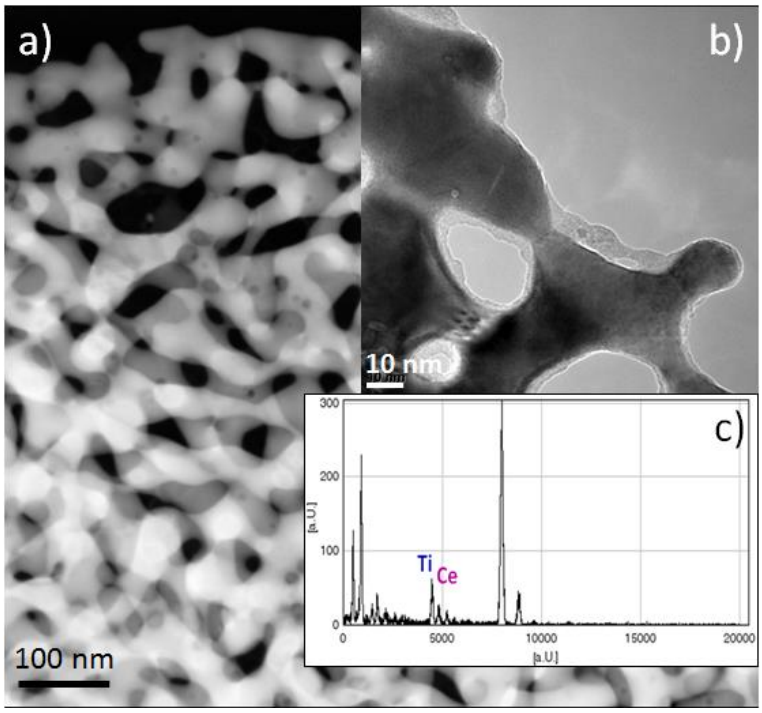

Figure S3: Selected a) STEM b) TEM c) EDX images of the titania-ceria mixed oxides modified nanoporous gold thin film (100 nm) after calcinations at 350°C for 2h.

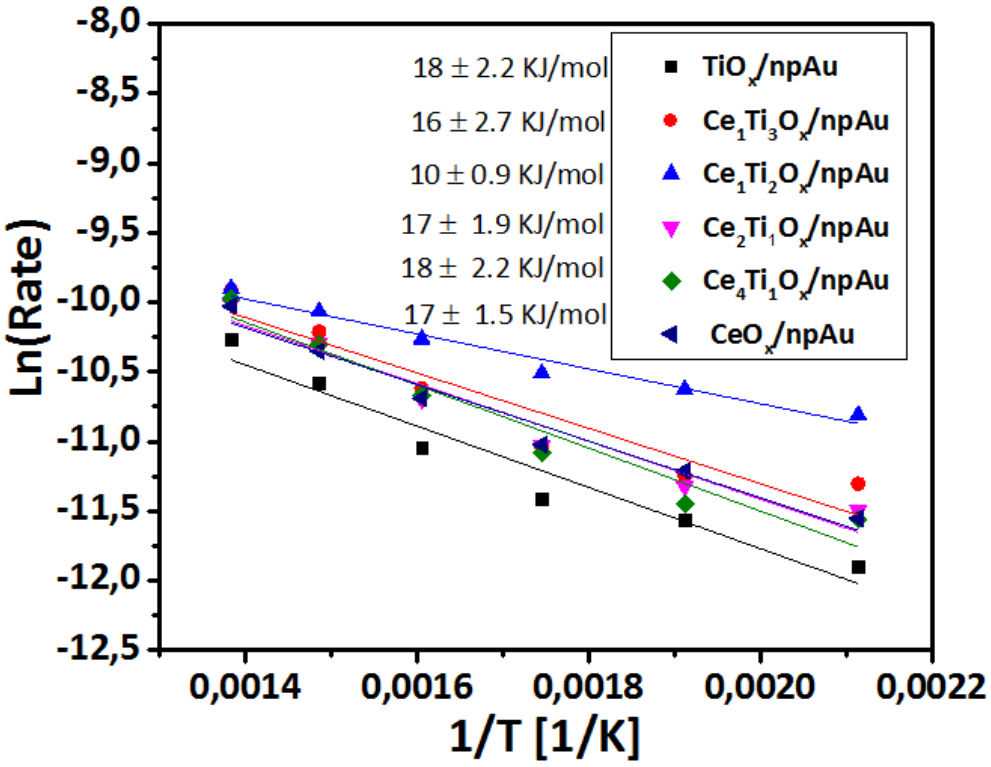

Figure S4. WGS activity ($CO + H_2O \rightarrow CO_2 + H_2$): Comparison of the Ea values of different mixed Ce-TiO_x and TiO_2, CeO_2 single oxide functionalized np-Au samples (150 µm thick). (5.8 vol% CO, 22.0 vol% H_2O in He, total gas flow 32 mL/min, M_{catal} = 6.0 ± 0.2 mg, space velocity 320,000 mL $h^{-1}g^{-1}$cat).

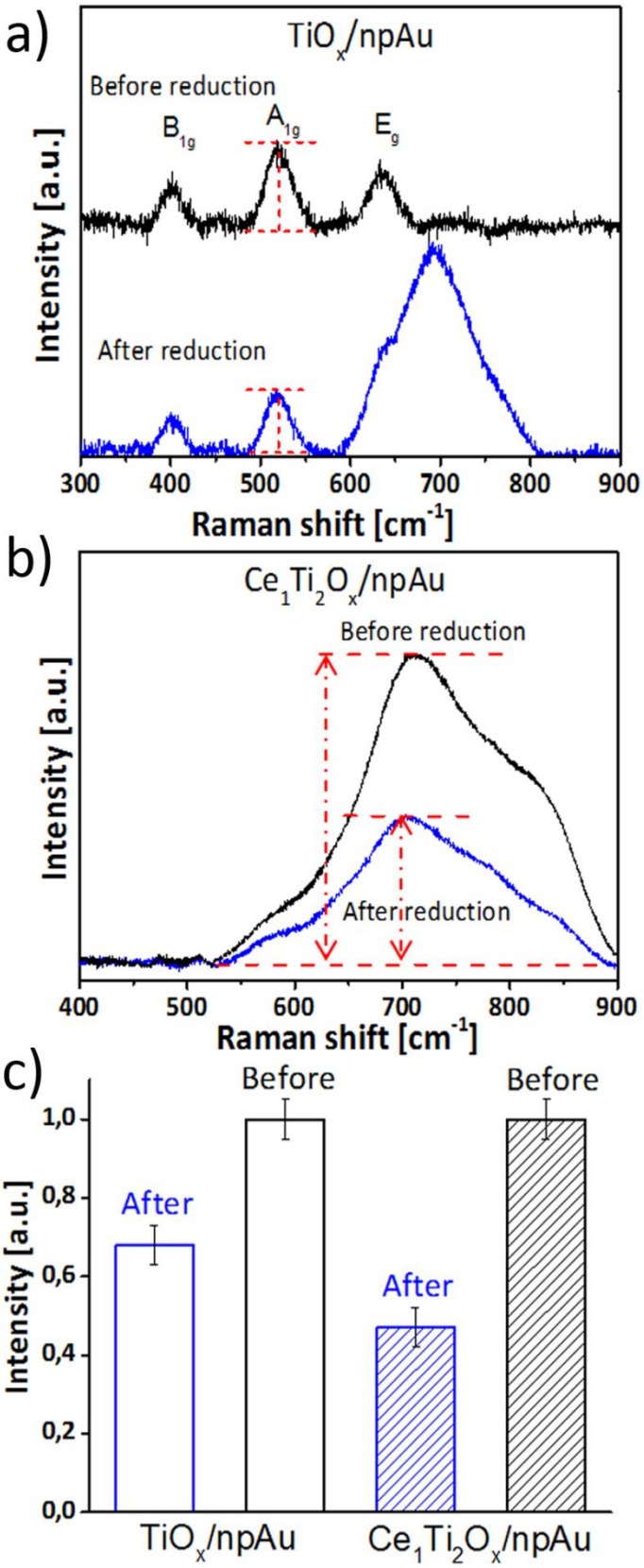

Figure S5: Raman spectra of a) TiO_x/npAu, b) $Ce_1Ti_2O_x$/npAu before and after CO reduction. After treating the sample in O_2 atmosphere at 400 °C for 2h, broke the sample into two pieces. Then took part of the oxidized sample and reduced it under CO atmosphere at 400 °C for 2h. c) Compare the D peak's intensity change before and after CO reduction for TiO_x/npAu and $Ce_1Ti_2O_x$/npAu.

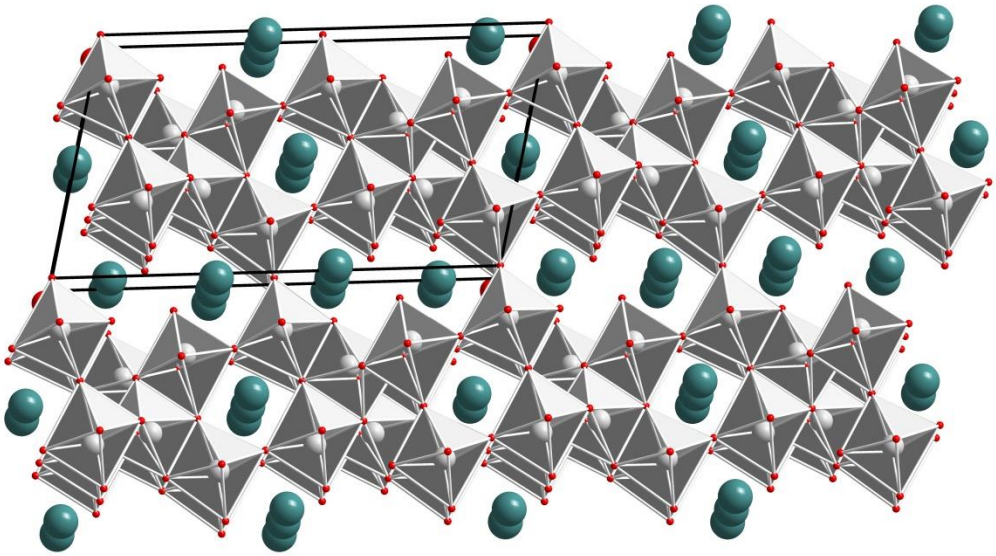

Figure S6: Crystal structure of $Ce_2Ti_2O_7$ (perovskite like structure), the black line represents the unit cell. Color code for atoms: red/oxygen, grey/titanium, green/cerium. (see also Gao et al., *J. Am. Ceram. Soc.*, 2015, 1-5). One can distinguish the layers of TiO_6 octaeders and the cerium atoms occupying interstitial sites.