Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Supplementary Information

Porous PtPd alloy nanotubes. Towards high performance electrocatalysts with low Pt-loading

Ayoub Laghrissi [a] and Mohammed Es-Souni * [a]

[a] Institute for Materials & Surface Technology, University of Applied Sciences, Kiel, Germany

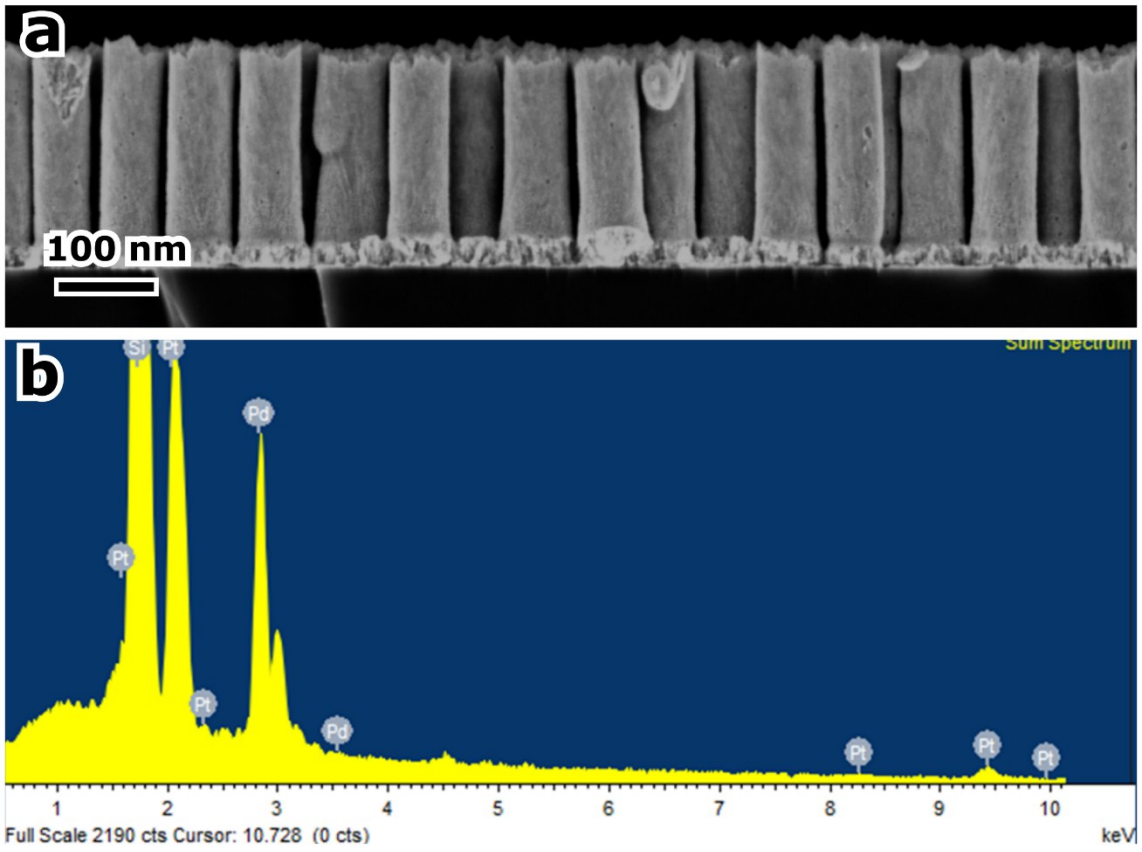

Fig. S1 SEM micrograph showing a cross section of a PtPd alloy NRs sample (a) , and corresponding EDS spectrum (b).

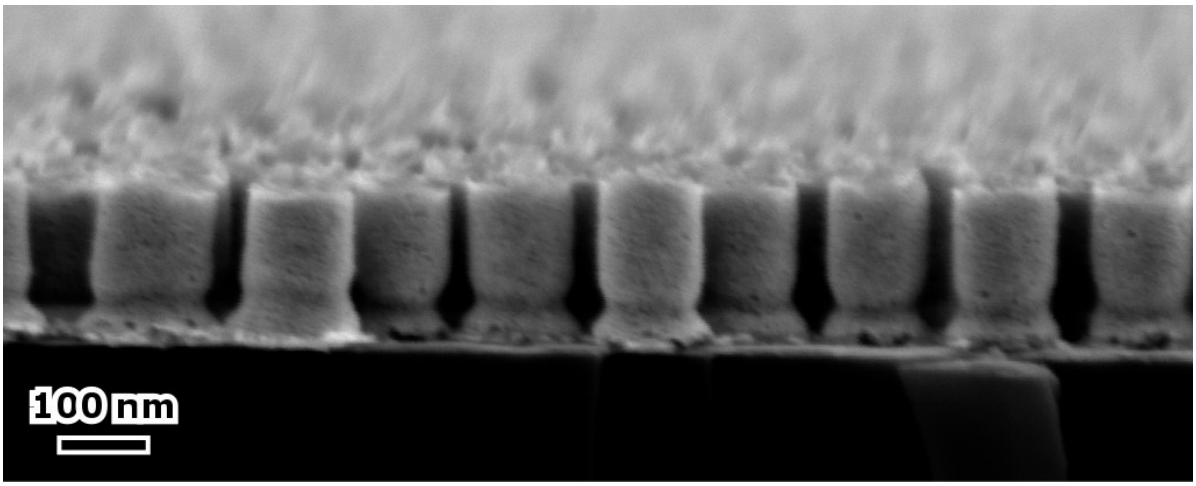

Fig. S2 Cross-section of Pt array electrodeposited at -0.5 V with no Brij58 in the solution.

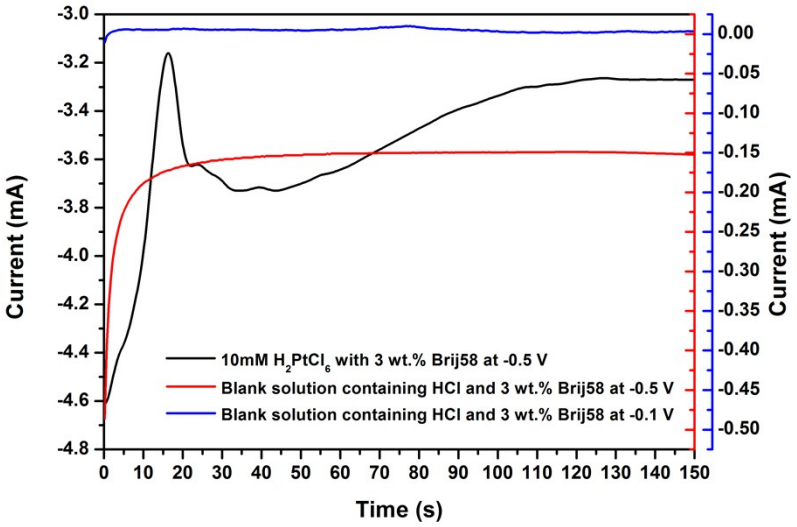

Fig. S3 The chronoamperometric curves corresponding to the potentiostatic electrodeposition of the porous Pt NTs at -0.5 V, and hydrogen evolution test done in a blank solution containing HCl and 3 wt.% Brij58 (pH=2.5) at -0.1 V and -0.5 V.

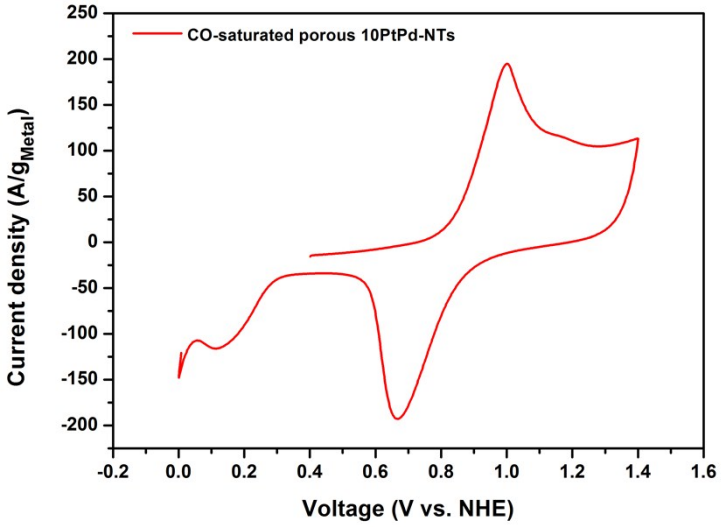

Fig. S4 CO oxidation voltammogram of a CO-saturated porous 10PtPd-NTs in CO-free 0.5 M H_2SO_4 electrolyte. Scan rate: 50 mV s^{-1}.

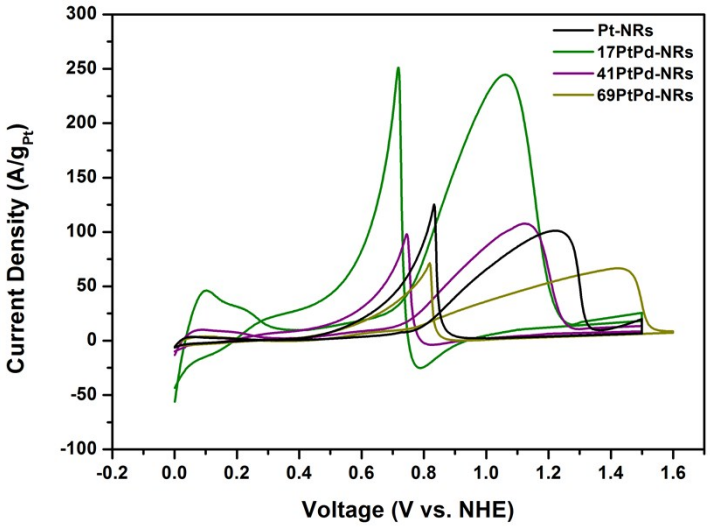

Fig. S5 Current density (current normalized by the Pt-mass) vs. voltage of the plain PtPd-NRs containing different Pt-contents in 0.5 M H_2SO_4 + 0.5 M CH_3OH. Scan rate: 50 mV s^{-1}.

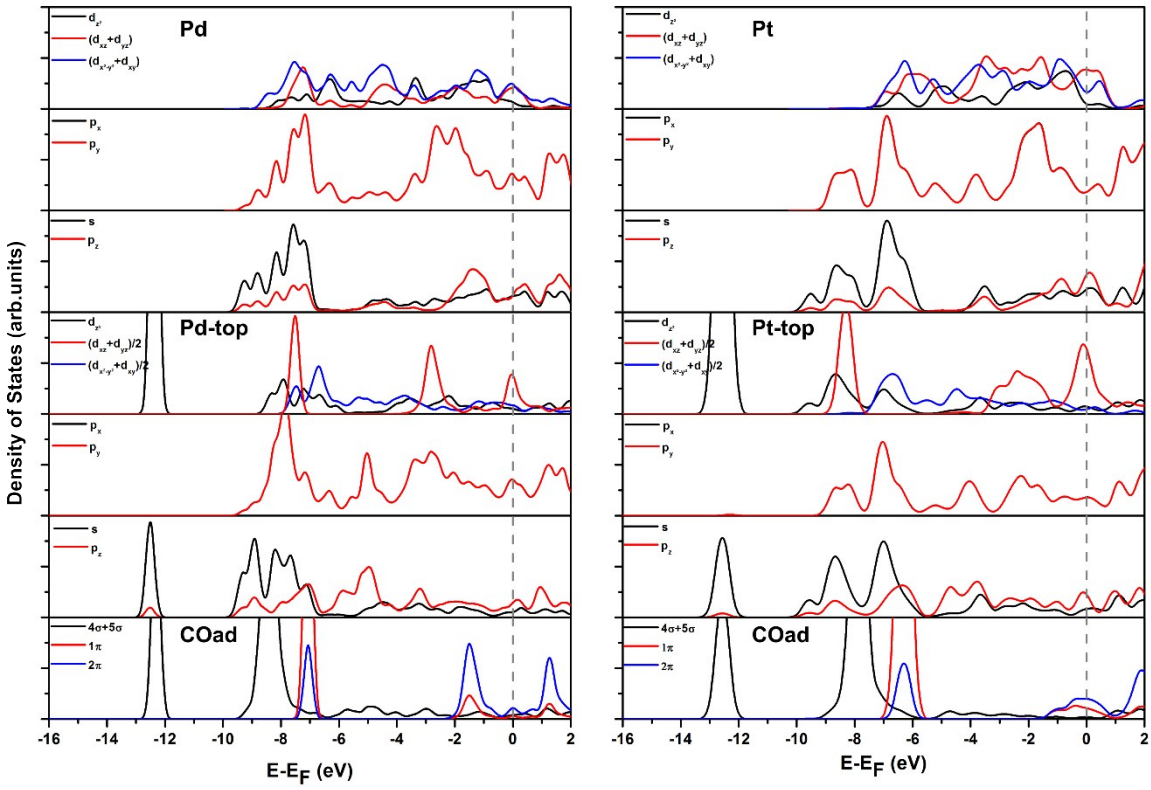

Fig. S6 Orbital electronic density of states for top sites of pure Pt, and Pd atoms, and adsorbed CO. This Figure shows s, p, and d –states for pure Pd and Pt. The d band center is -2.41 eV for Pt and -1.94 eV for Pd, the s- and p-band are covering a large energy range. p_x and p_y degenerate, and the p_z show different behavior than later ones. Considering the effect of CO molecule on the metal states Pd and Pt, one can observe different qualitative behaviors, the d-band is extended to a large energy range; more important new states were a rise in d_z^2 and sp_z from the interaction with σ. For CO the 4σ+5σ peaks positions for Pt (-8.5 eV) and Pd (-8 eV), the 2π get partially occupied at the same energy level with 1π.

Table S1 Volume fractions of 10 mM H_2PtCl_6 and 10 mM K_2PdCl_4 aqueous electrolytes, and their corresponding Pt-content obtained from EDS analysis, and from XRD (the calculated lattice parameters and Vegard's law).

Volume Fraction	Pt-Content from EDS (at%)	Pt-Content from XRD (at%)
Porous PtPd NTs		
1:19	5.5	5
2:18	10.54	10
3:16	17.44	18
4:16	22.40	23
7:12	49.04	43
Plain PtPd NRs		
1:4	10.78	17
4:5	42.24	41
7:4	68.51	69