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Supporting information

Pt and RhPt dendritic nanowires and their potential application as anodic catalysts for fuel cells

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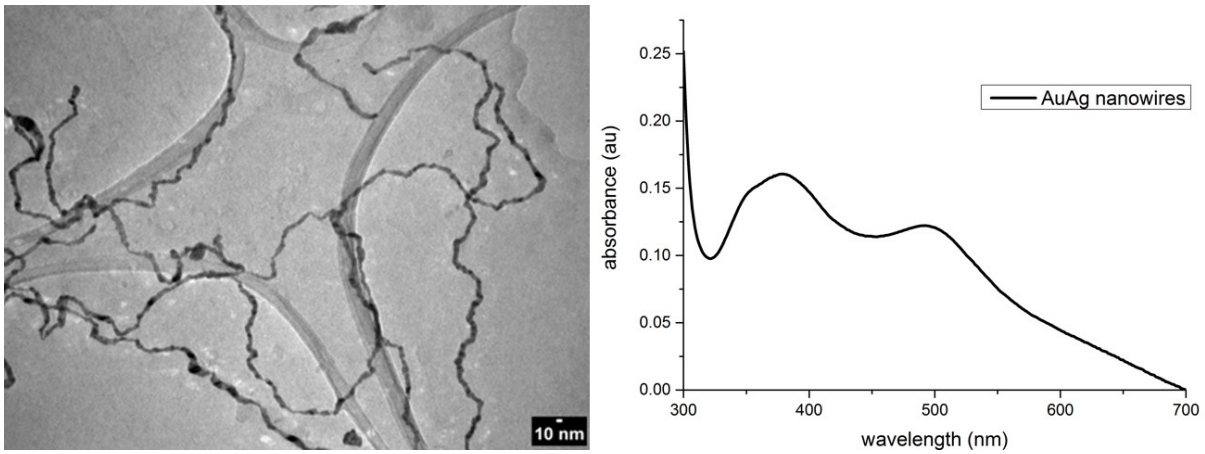

Fig. S1: TEM image (left) and corresponding UV-Vis spectrum of ultrathin AuAg NWs**.**

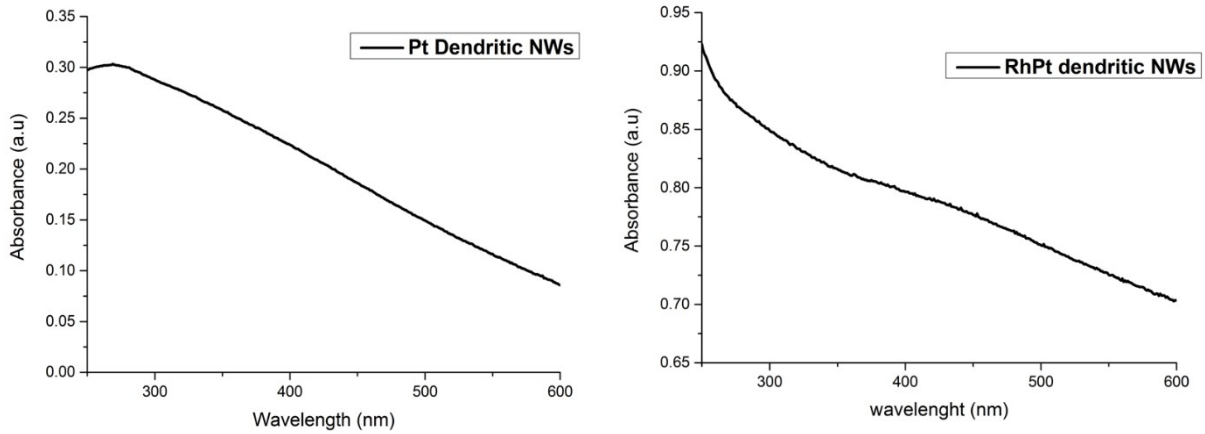

Fig. S2: UV-vis spectra of Pt (left) and RhPt (right) dendritic NWs.

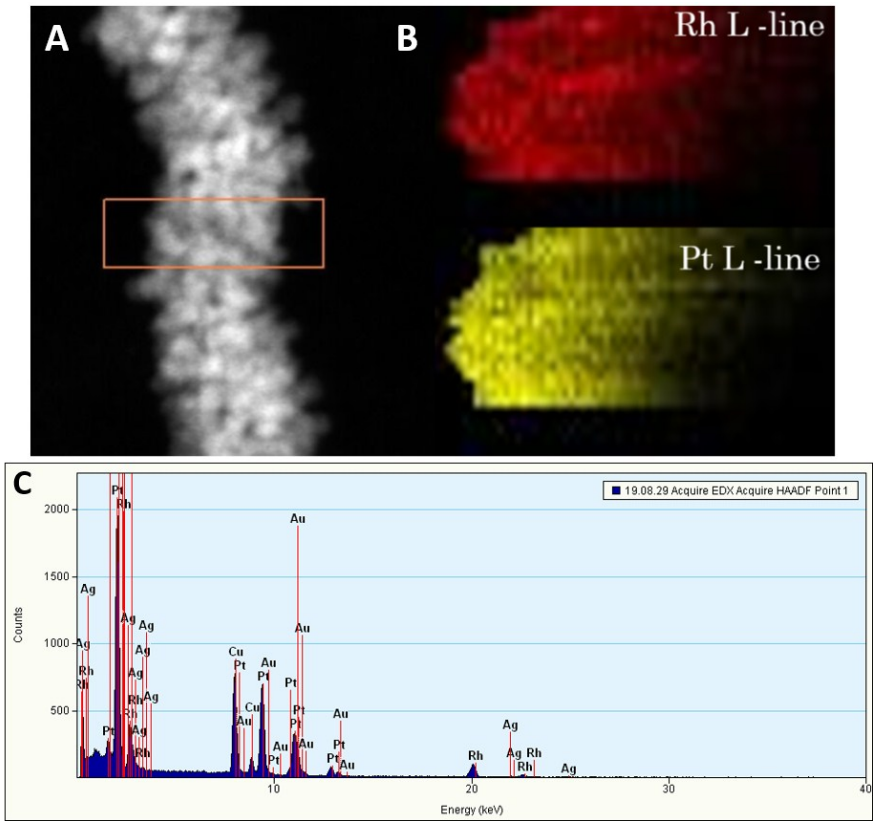

Fig. S3: HAADF STEM image highlighting region of interest (A), EDX maps of Pt and Rh L lines (B) and corresponding EDX spectrum (C) of RhPt dendritic NWs. The red markers indicate positions were the characteristic peaks are expected.

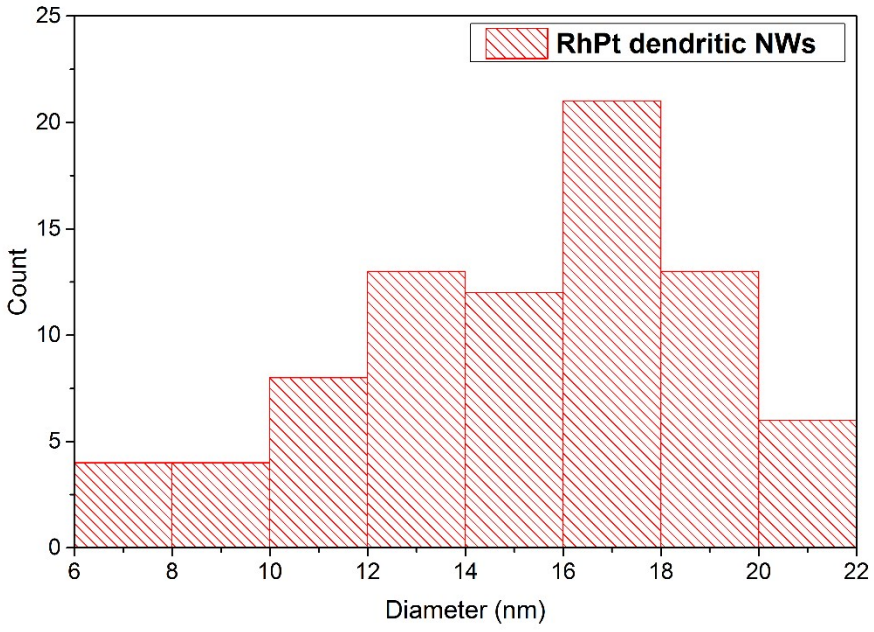

Fig. S4: Size distribution of RhPt dendritic NWs produced after 2.5 mins with average diameter of 15.1 nm.

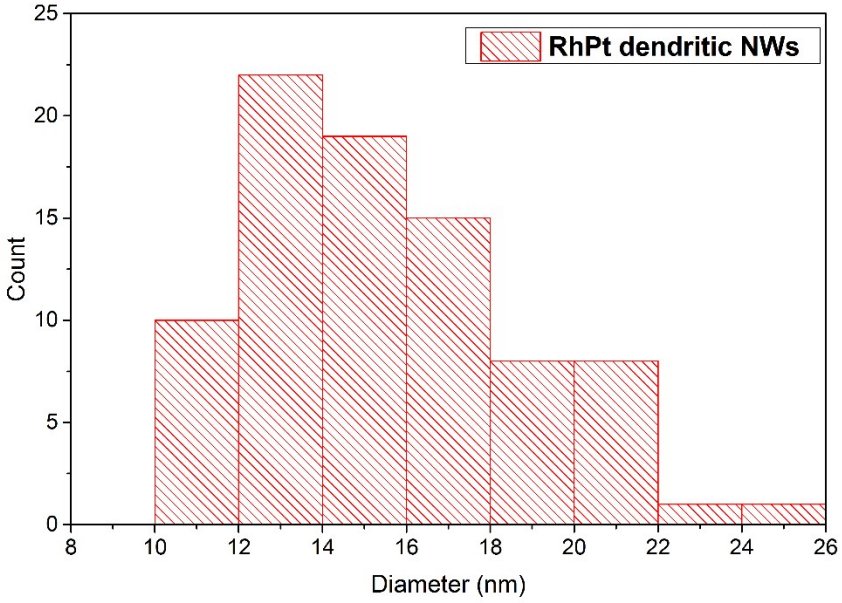

Fig. S5: Size distribution of RhPt dendritic NWs produced after 10 mins with average diameter of 15.5 nm.

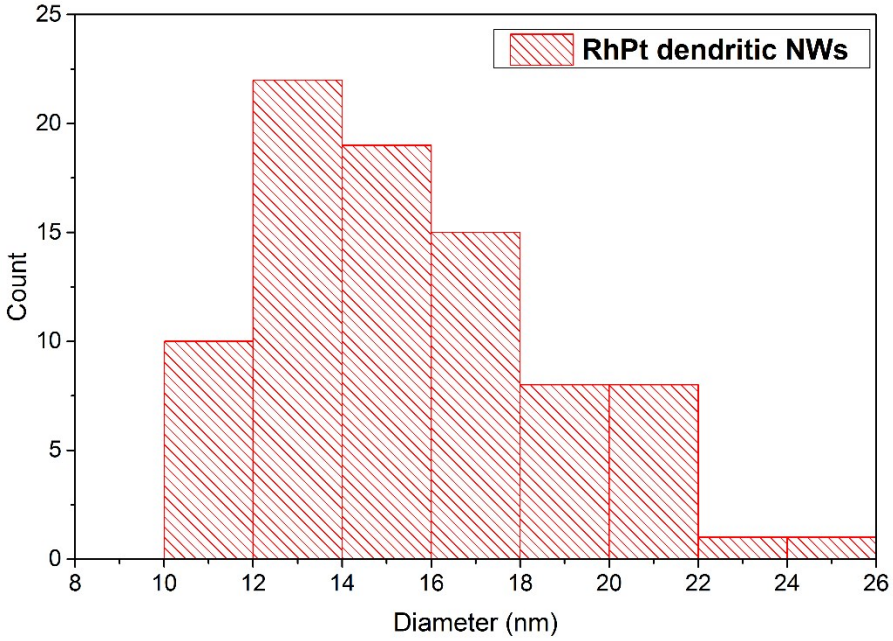

Fig. S6: Size distribution of RhPt dendritic NWs produced after 15 mins with average diameter of 22.4 nm.

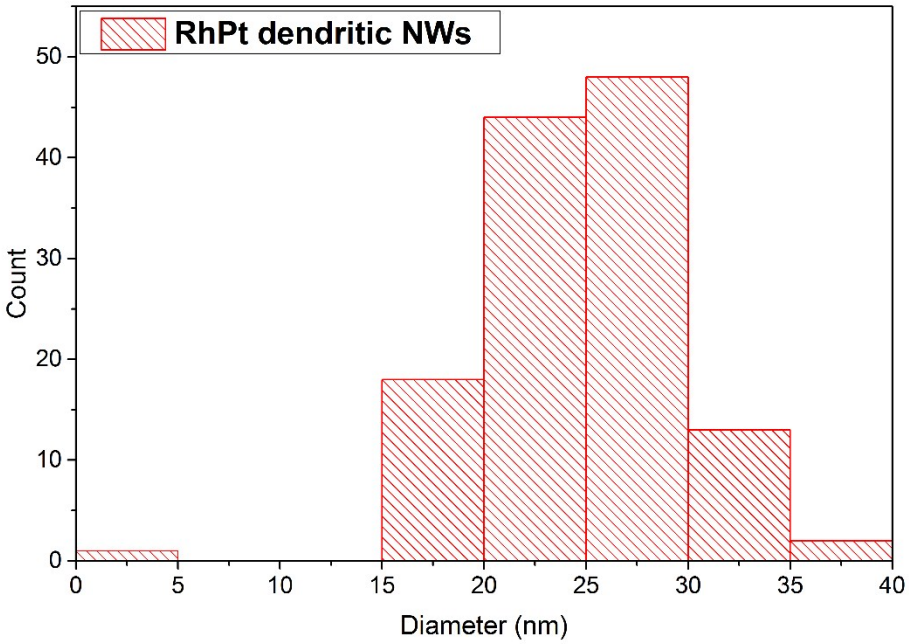

Fig. S7: Size distribution of RhPt dendritic NWs produced after 25 mins with average diameter of 24.7 nm.

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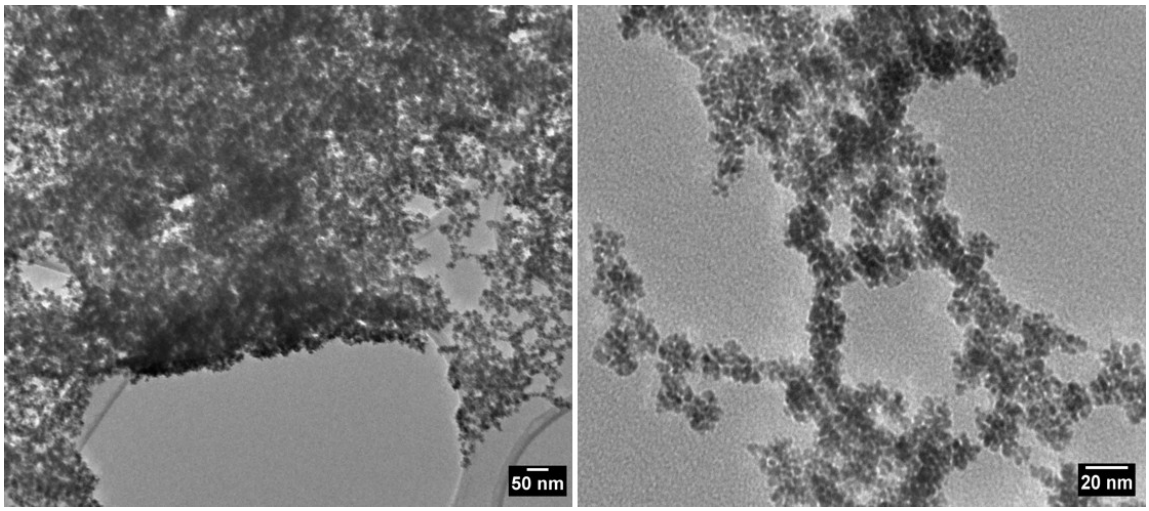

Fig. S8: TEM images of RhPt dendritic NWs synthesis in the absence of PVP.

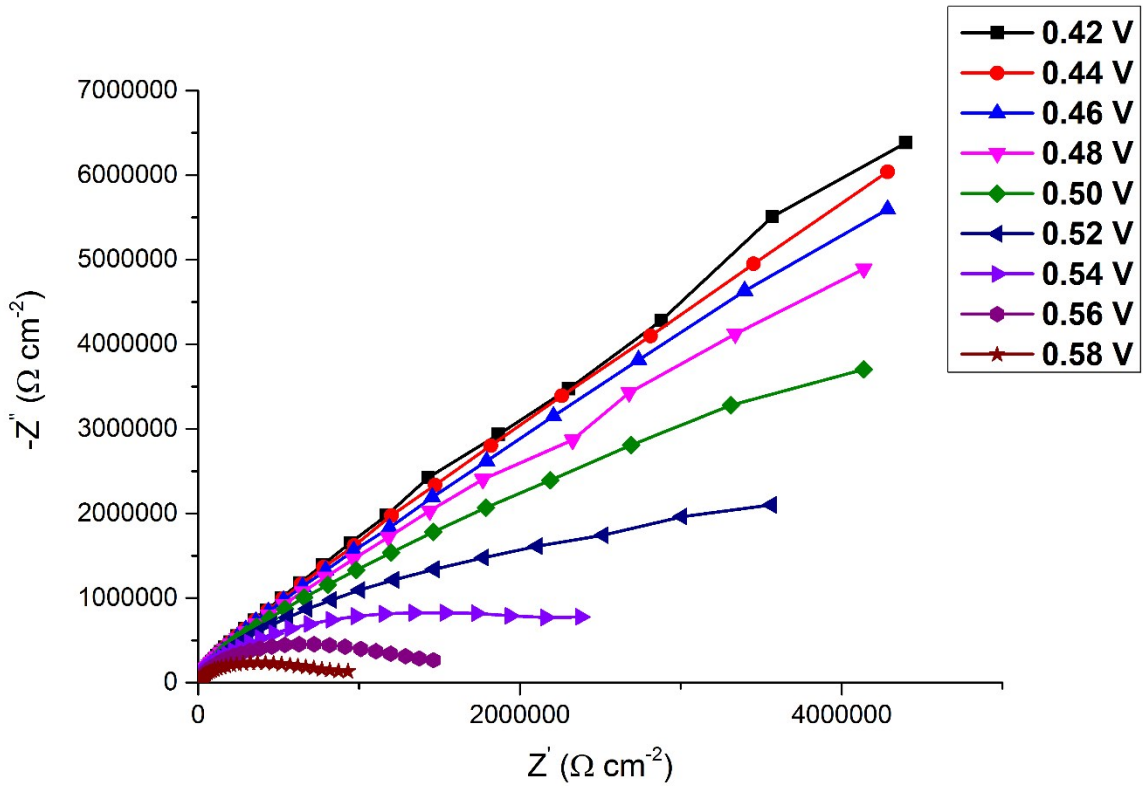

Fig. S9: Nyquist plot of RhPt dendritic NWs in 1M methanol + 0.5 M perchloric acid solution versus the Ag/AgCl reference electrode at 25°C .

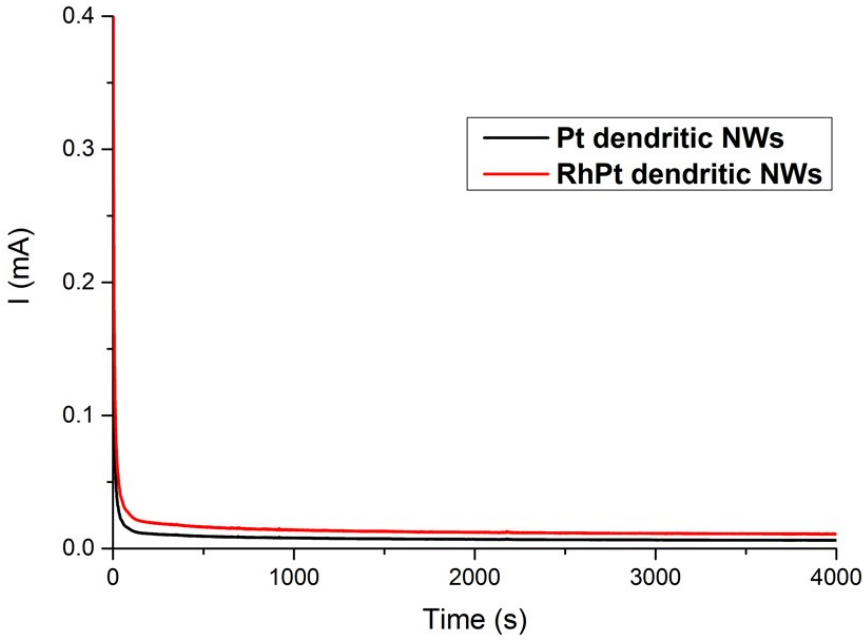

Fig. S10: I-t curve over 4000 s of Pt and RhPt dendritic NWs in N_2-saturated 1 M H_2SO_4 solution containing 0.5 M formic acid.

The electrochemical active surface areas of both catalysts was determined by integrating the area within the hydrogen adsorption region (-0.25 - 0 V) and dividing by the charge density associated with the deposition of a hydrogen monolayer on planar polycrystalline Pt typically 0.21 mC cm^{-2}. ESCA normalised CV analysis for Pt and RhPt dendritic NWs is shown in Figure S6.

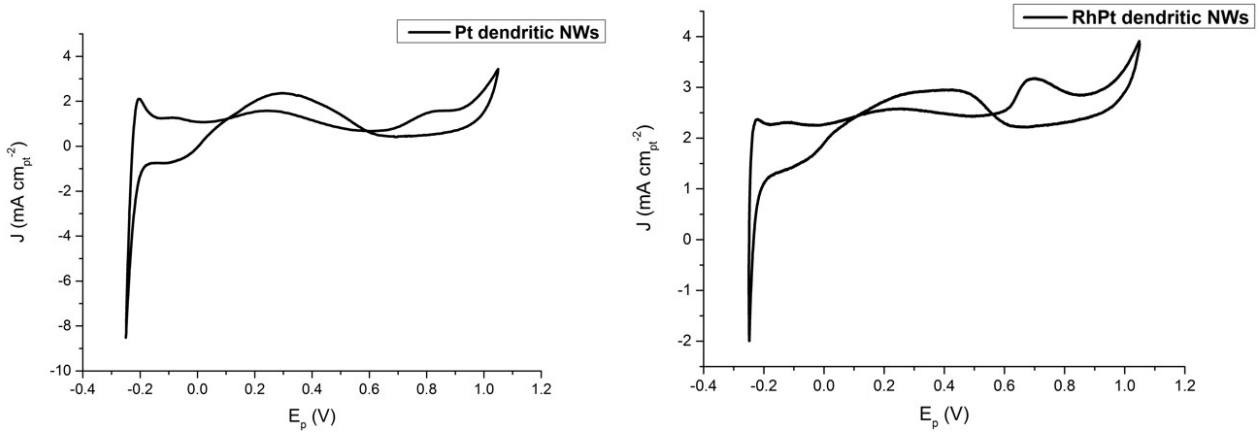

Fig. S8: ESCA normalised CV analysis of formic acid oxidation at 50 mV s^{-1} for Pt (left) and RhPt (right) dendritic NWs versus Ag/AgCl reference electrode in a 1 M H_2SO_4 solution containing 0.5 M Formic acid. The peak current densities in the forward scan was determined to be 1.5 and 3.2 mA cm^{-2} for the Pt and RhPt dendritic NWs respectively.

Table S1: Electro-oxidation of formic acid by various noble metal catalyst in acidic medium.

Catalyst	E_p (V)	J (mA cm^{-2})
Rh nanochains[1]	0.42 (vs Hg/Hg_2SO_4)	0.55
Pt NWs[2]	0.7 (vs sat. Calomel)	1.75
Pt_{71} Au_{29} NWs[2]	0.58 (vs sat. Calomel)	1.2
$Pd_{0.65}$ Ag_1/CNT[3]	*ca.* 0.37 (Hg/HgO)	2.16
PtZn NWs[4] (1.8 nm)	*ca.* 0.63 (vs sat. Calomel)	3.9
Pd_3Ag_1 nanotrees[5]	*ca.* 0.48 (vs RHE)	3.26
PtAg NWs[6]	0.57 (vs RHE)	1.03
Pd NWs[7] (2 nm)	0.64 (vs RHE)	2.4
Pt dendritic NWs (this work)	0.83 (vs Ag/AgCl)	1.5
PtRh dendritic NWs (this work)	0.69 (vs Ag/AgCl)	3.1

CNT = carbon nanotube NP = nanoparticle RHE = relative hydrogen electrode.

References

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