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Supporting Information

Multi-Component PtFeCoNi Core-Shell Nanoparticles on MWCNTs as Promising Bifunctional Catalyst for Oxygen Reduction and Oxygen Evolution Reactions

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Table S1. XPS peak fit parameters (binding energy [FWHM], both in eV)

	Species	PTFCN@NT	PFCN@NT^{300}
C 1s	sp^2-C	284.61 [0.69]	284.62 [0.67]
	C-C/C-H	285.22 [1.33]	285.20 [1.20]
	C-O	286.50 [1.60]	286.52 [1.66]
	C=O	288.62 [2.20]	288.60 [1.80]
	π-π*	291.00 [2.20]	291.02 [2.20]
O 1s	TM-O	530.00 [1.60]	530.04 [1.63]
	O=C/ TM-OH	531.62 [1.74]	531.58 [1.71]
	O-C	533.00 [2.11]	533.02 [2.20]
Fe $2p_{3/2}$	Main peak	712.14 [5.00]	711.60 [4.19]
	Satellite	718.90 [7.00]	718.33 [7.00]
	Co Auger	715.94 [4.00]	715.35 [4.00]
Co $2p_{3/2}$	Main peak	781.53 [2.75]	780.85 [3.00]
	Satellite	786.03 [7.55]	785.46 [7.87]
Ni $2p_{3/2}$	Main peak	856.39 [2.44]	855.63 [3.22]
	Satellite	861.96 [6.00]	861.65 [5.57]
Pt $4f_{7/2}$	Metal	71.62 [1.09]	71.68 [1.31]

Peak fitting was done using Shirley-type backgrounds and Gaussian-Lorentzian peak shapes (except of the C 1s peak of sp^2-C and the Pt 4f peak doublet, where an asymmetric shape is expected). For the peak doublets, the intensity ratio (4:3 for Pt 4f and 2:1 for Fe 2p, Co 2p and Ni 2p) and the spin-orbit-splitting were fixed to the expected values.[1]

[1] J. F. Moulder, W. F. Stickle, P. E. Sobol, K. D. Bomben, *Handbook of X-Ray Photoelectron Spectroscopy. Update.*, Perkin-Elmer Corporation, Eden Prairie, Minn., **1992**.

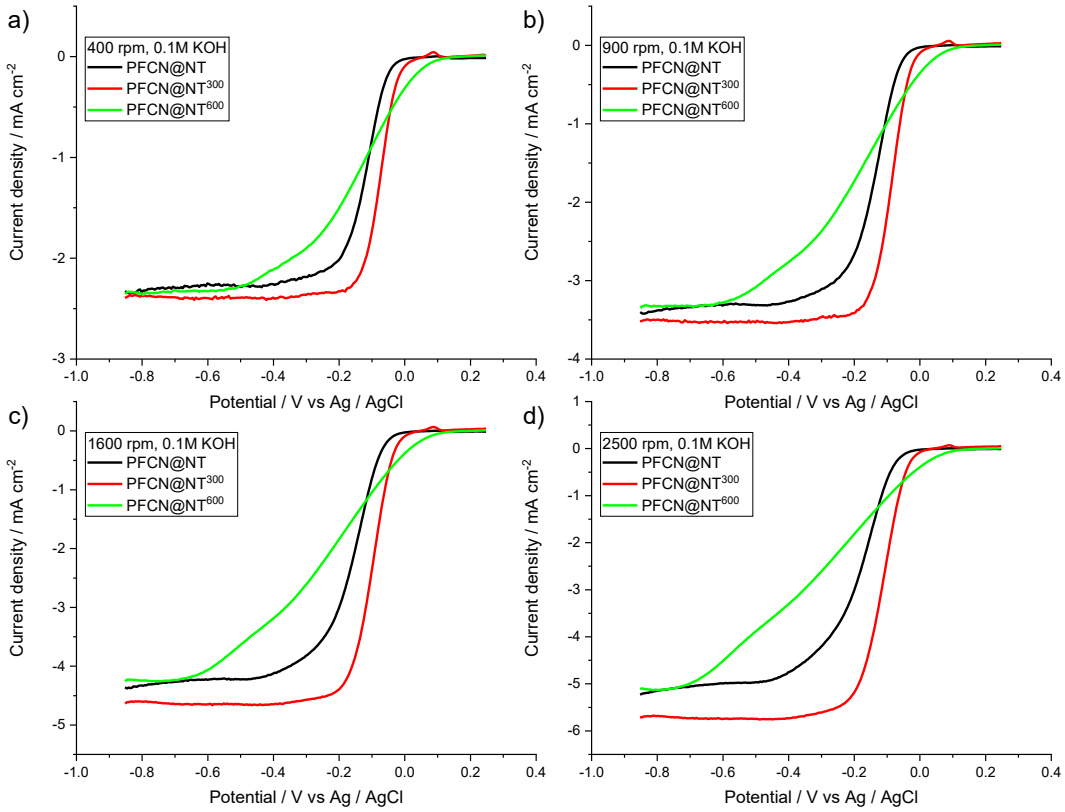

Figure S1: *RRDE measurements of PFCN@NT, PFCN@NT^{300} and PFCN@NT ^{600} in 0.1 M KOH with a rotation rate of a) 400, b) 900, c) 1600 and d) 2500 rpm*

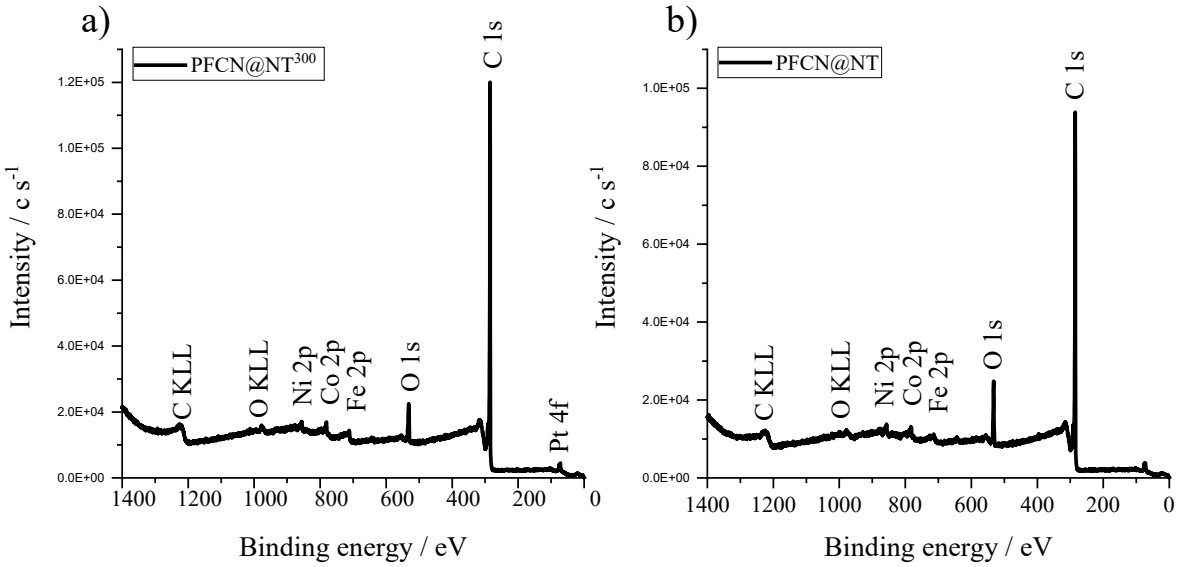

Figure S2: *XPS survey measurements of a) PFCN@NT^{300} and b) PFCN@NT.*

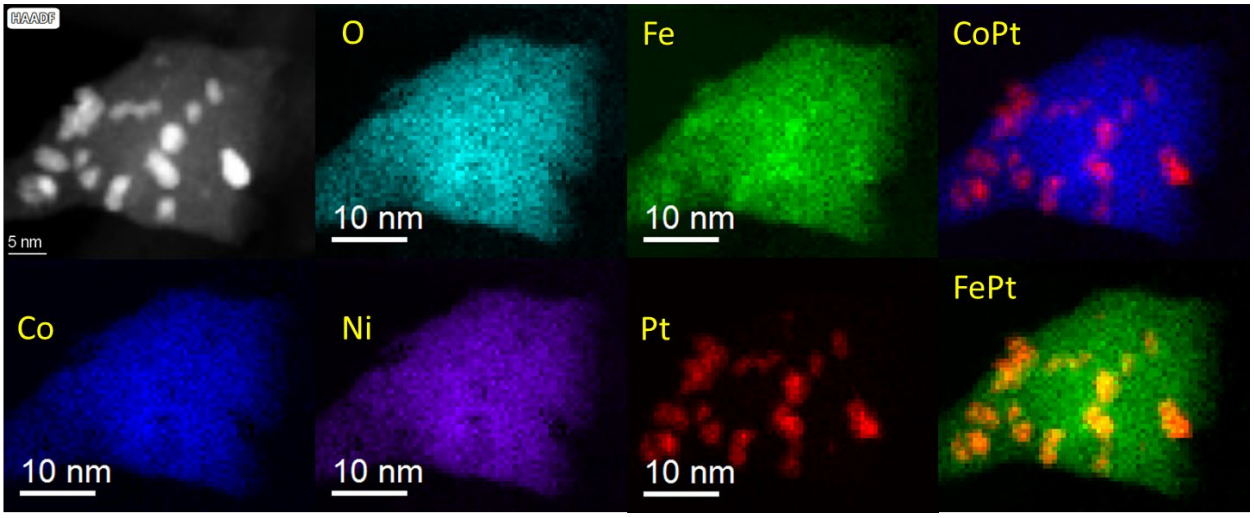

Figure S3: *HAADF-Images and elemental distribution of PFCN@NT.*

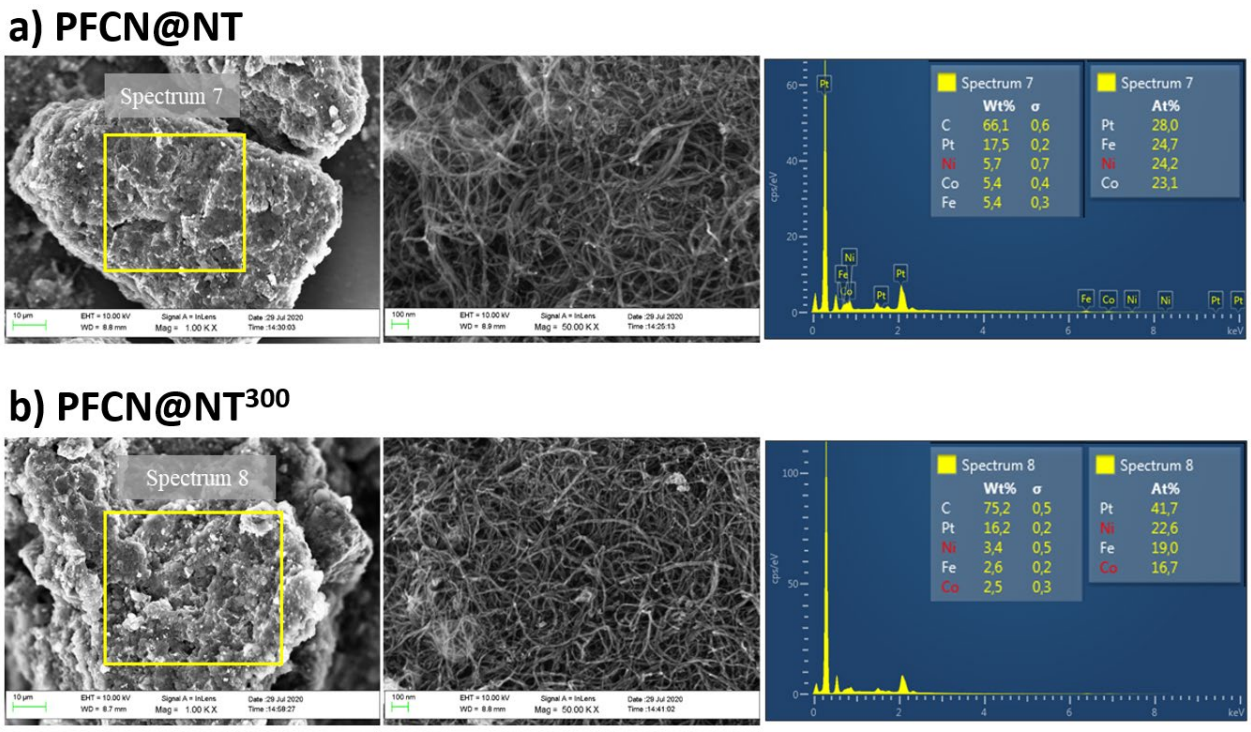

Figure S4: *SEM images and EDX result for a) PFCN@NT and b) PFCN@NT^{300}.*

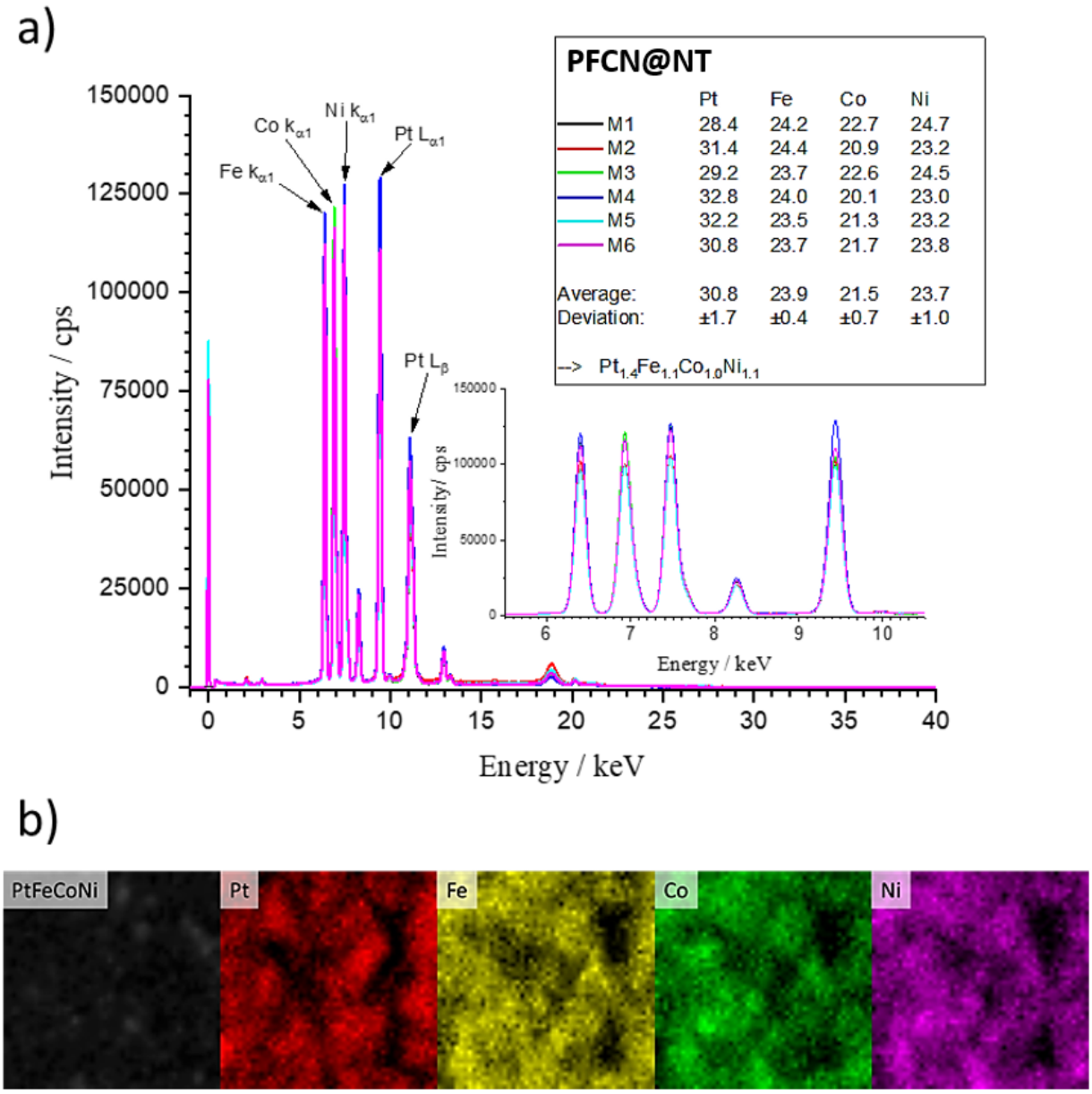

Figure S5: *a) RXF survey measurement with atomic ratio and b) elemental distribution by XRF.*

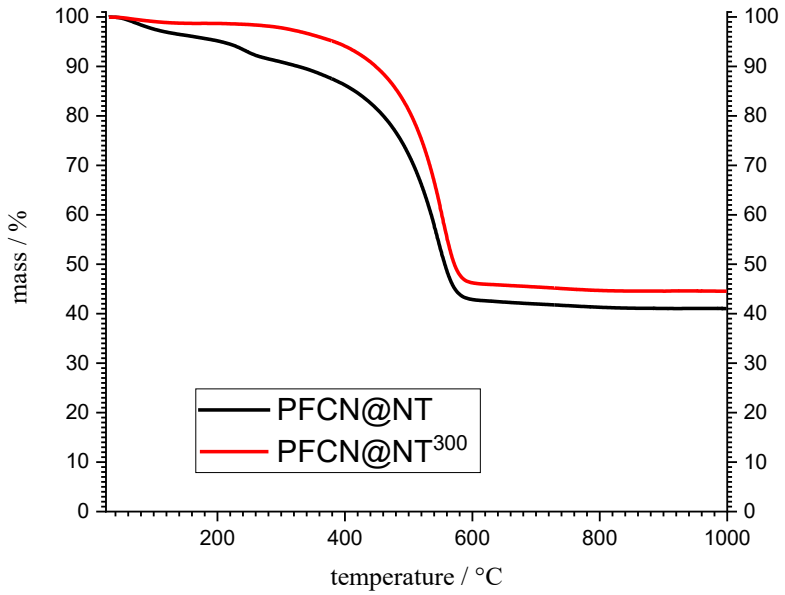

Figure S6: *TGA measurements up to 1000 °C conducted in N_2/O_2 flow.*

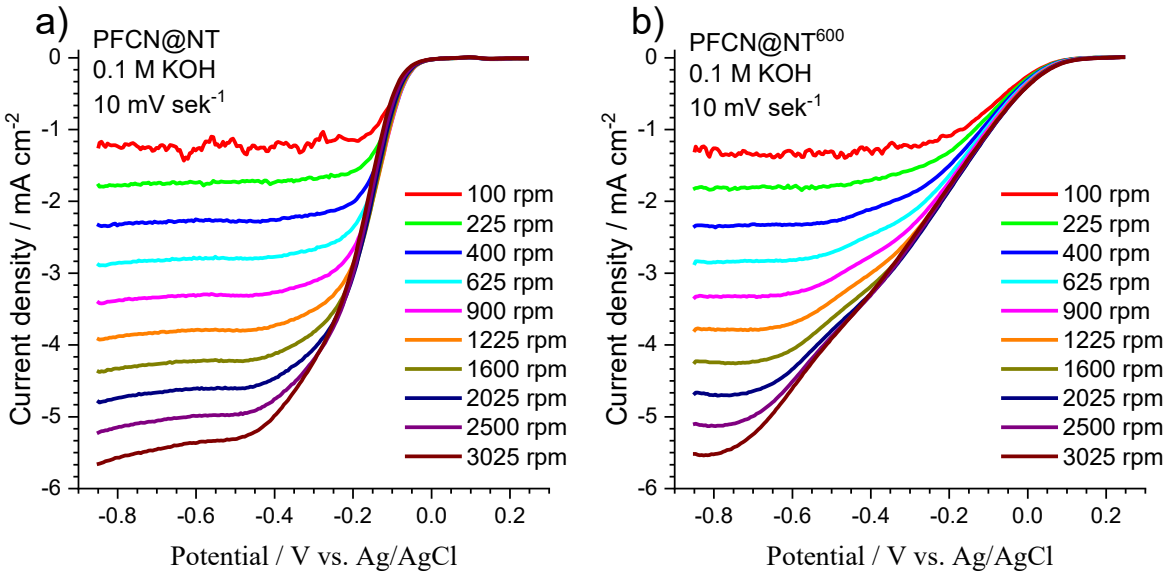

Figure S7: *ORR curves of a) PFCN@NT and b) PFCN@NT^{600} with different rotation rates in 0.1 M KOH.*

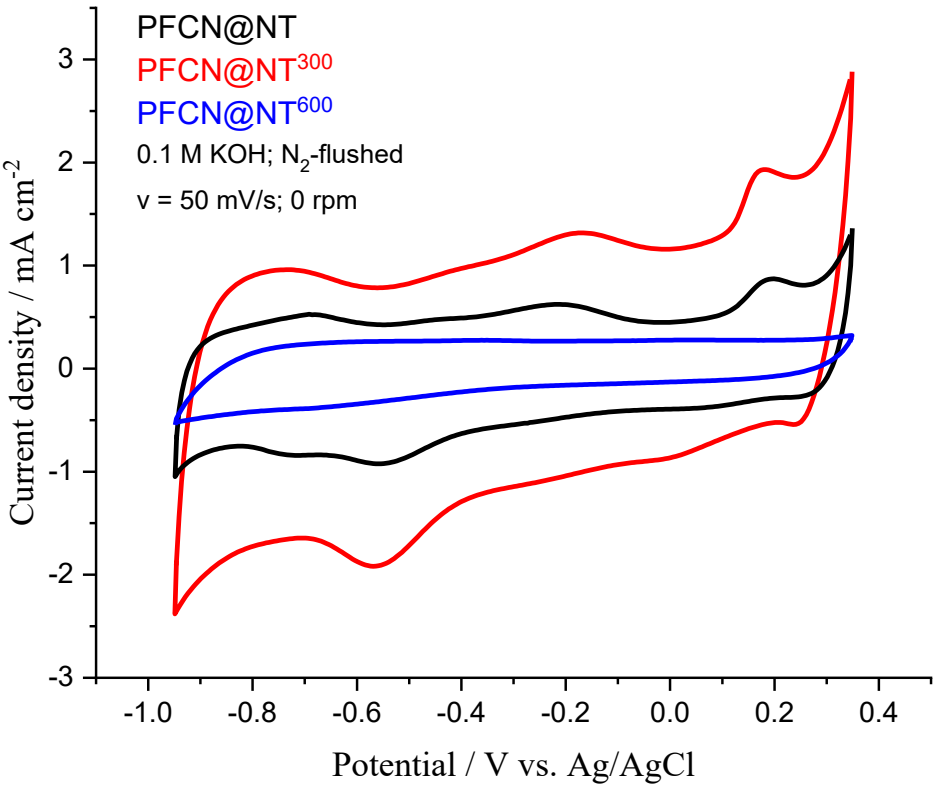

Figure S8: *Cover layer graph of the different catalysts for determination of the ECSA.*

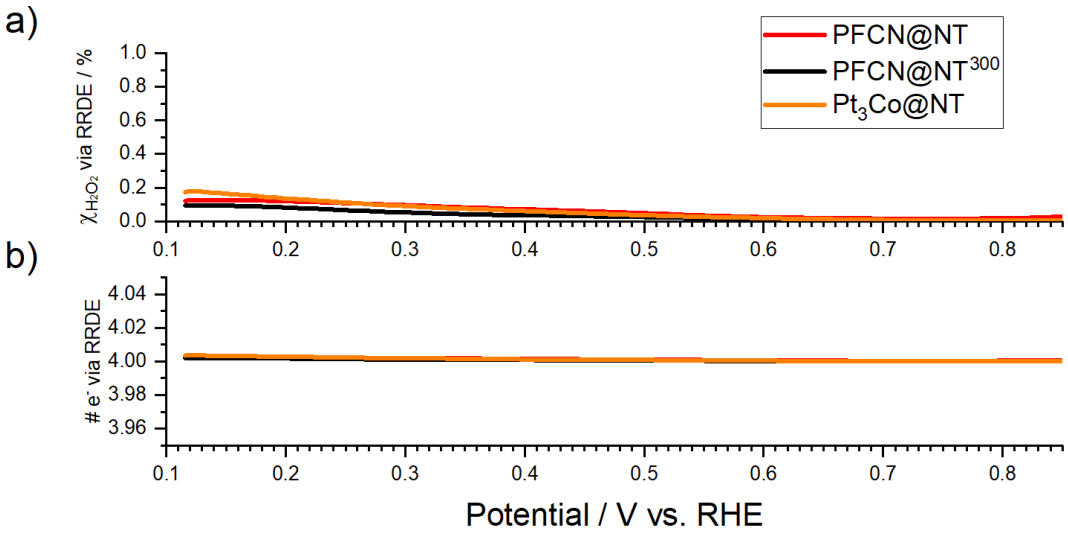

Figure S9: *Results of RRDE experiments for PFCN@NT, PFCN@NT300 and Pt3Co@NT in the potential range of 0.15 V and 0.85 V vs. RHE. a) Amount of H_2O_2 produced. b) Number of electrons transferred.*