Table S 1: Catalytic data in aqueous solution.

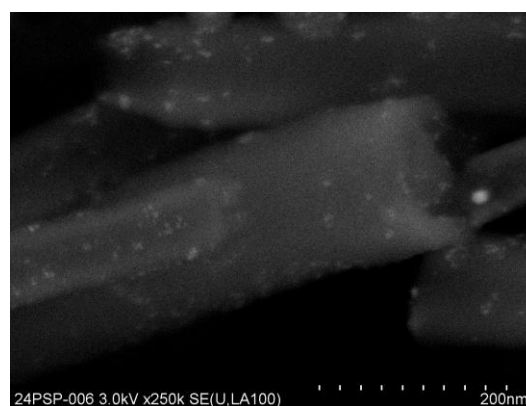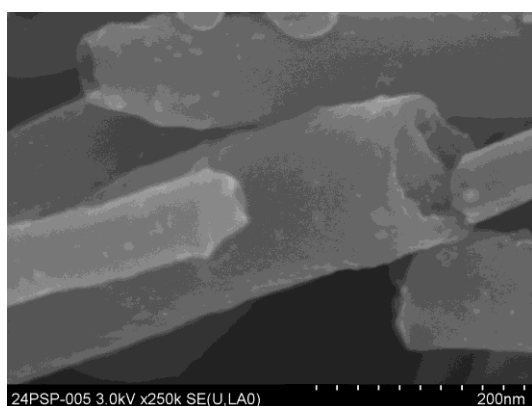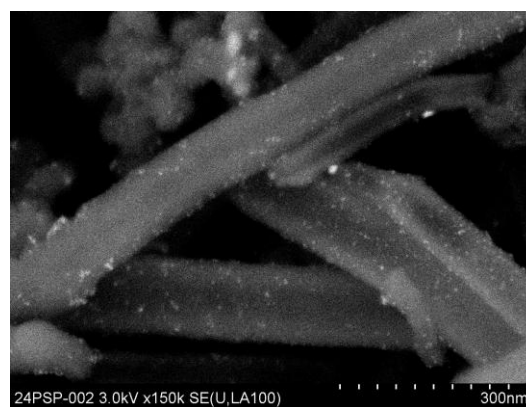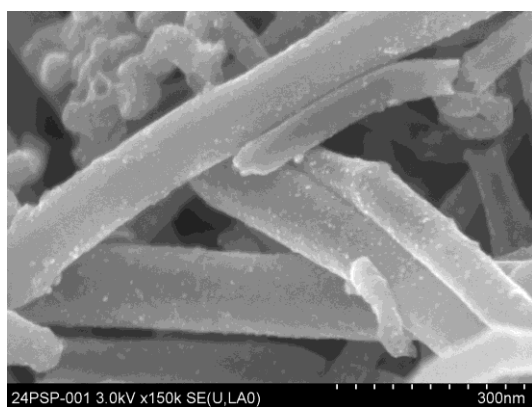| Catalyst	Time	Conversion	Selectivity			
			Aldehyde	Benzoic acid	Toluene	Benzyl benzoate
Pd/NCNF873K	0.5 h	46	95.6	3.9	0	0.5
	2 h	92	91.8	8	0	0.2
Pd/NCNF673K	0.5 h	35	95.4	3.7	0	0.9
	2 h	90	94.6	4.8	0	0.6
Pd/NCNF473K	0.5 h	33	96.8	0.9	0	2.3
	2 h	70	95.7	3.6	0	0.7
Pd/CNF ox	0.5 h	25	96.2	0	3.8	0
	2 h	34	97.8	1.3	0.9	0
Pd/VGCNF	0.5h	5	96.8	0	2.1	1.1
	2 h	18	93.1	6.2	0.1	0.6

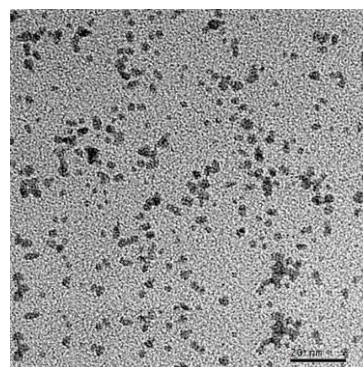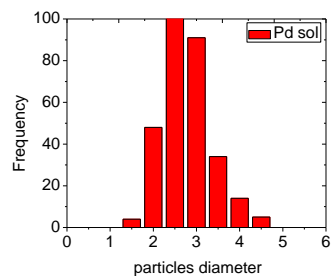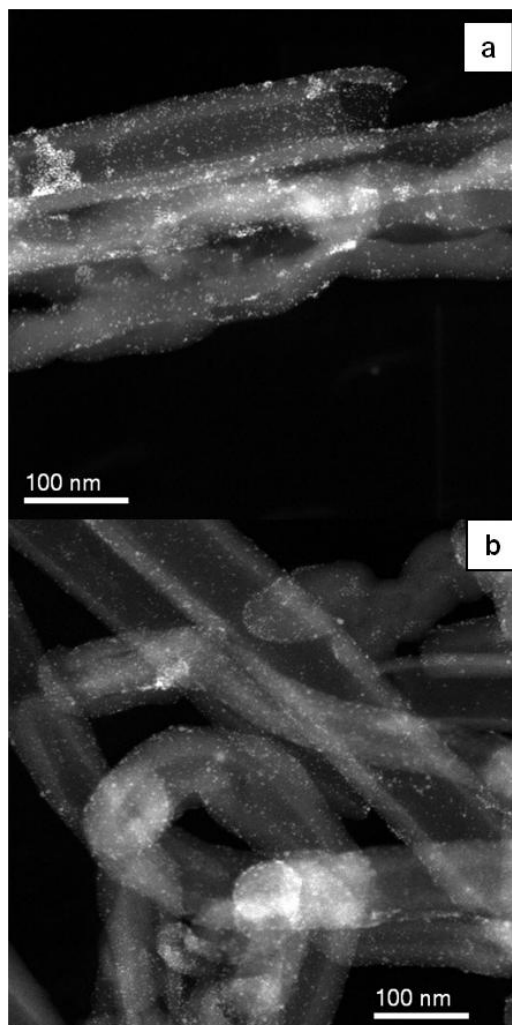**Figure S 1:** SE (left) and BSE (right) SEM images for the sample Pd-PVA /N-CNT.

Figure S 3: Pd sol: Pd particles size distribution; TEM image.

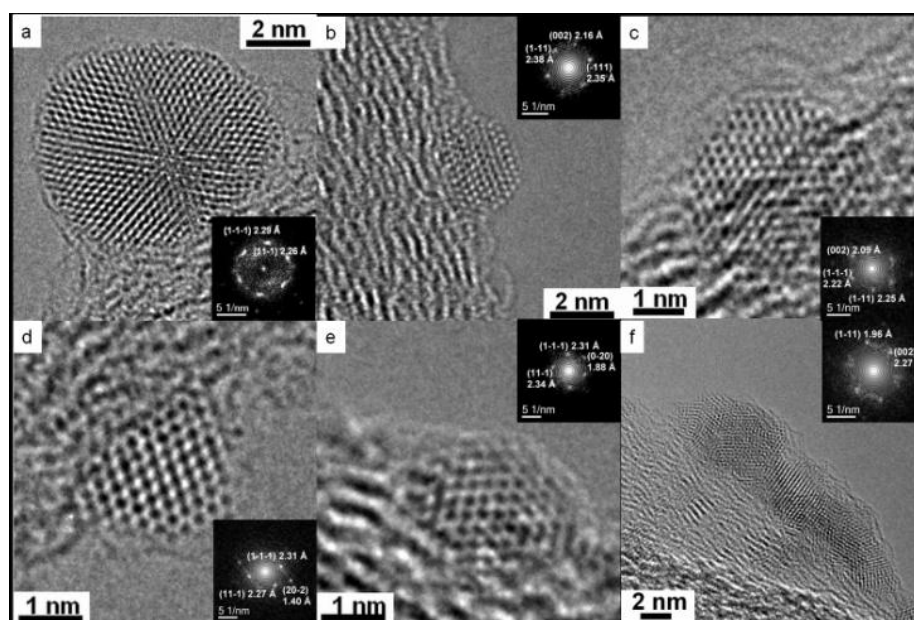**Figure S2**: (a) HAADF-STEM image for Pd/N-CNT473K; (b) HAADF-STEM image for Pd/N-CNT873K.

Figure S4: Figure 1: HRTEM image for sample Pd/CNT(a); HRTEM image for sample Pd/N-CNT673K (b); Pd/ CNTox (c); Pd/N-CNT873K (d);. Pd/N-CNT473K (e); agglomerated particles on Pd/N-CNT473K (f).
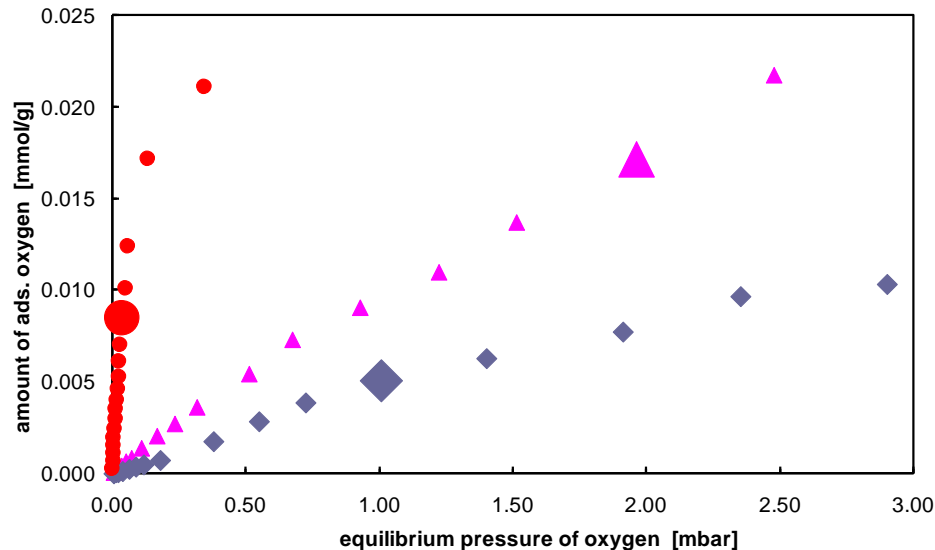
Figure S5: O_2 adsorption isotherms: Pd-PVA/N-CNT873K (violet rhombus); Pd-PVA/N-CNT473K (magenta triangles); Pdw.i./CNT (red circles). Bigger data point indicates the saturation concentration.

Table S2: Quantitative microcalorimetry data for the first 4 pulses. The amount of oxygen converted can be qualitatively estimated by the differential heat registered and amount of irreversible oxygen consumed. A more pronounced opposite tendency is indicative of higher amount of oxygen converted.

	Ads. Step O_2 80°C	*Pd/N-CNF473K - 4431*		*Pd/N-CNF873K - 4441*
1st	n_{dose}	0.0609 µmol	<	0.0648 µmol
	$n_{oxygen\,consumption}$	$3.9042*10^{-2}$ µmol/g	>	$2.289*10^{-2}$ µmol/g
	diff. heat	543kJ/mol	~	518 kJ/mol
2nd	n_{dose}	0.0835 µmol	>	0.0727 µmol
	$n_{oxygen\,consumption}$	$8.13*10^{-2}$ µmol/g	>	$1.3773*10^{-2}$ µmol/g
	diff. heat	351 kJ/mol	<	726 kJ/mol
3rd	n_{dose}	0.0938 µmol	<	0.1056 µmol
	$n_{oxygen\,consumption}$	$6.8331*10^{-2}$ µmol/g	>	$4.610*10^{-2}$ µmol/g
	diff. heat	464 kJ/mol	>	355 kJ/mol
4th	n_{dose}	0.109 µmol	<	0.1306 µmol
	$n_{oxygen\,consumption}$	$1.1515*10^{-1}$ µmol/g	>	$2.753*10^{-2}$ µmol/g
	diff. heat	464 kJ/mol	<	710 kJ/mol