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ELECTRONIC SUPLEMENTARY INFORMATION

A simple *in situ* synthesis of magnetic M@CNTs by thermolysis of the hybrid perovskite [TPrA][M(dca)$_3$]

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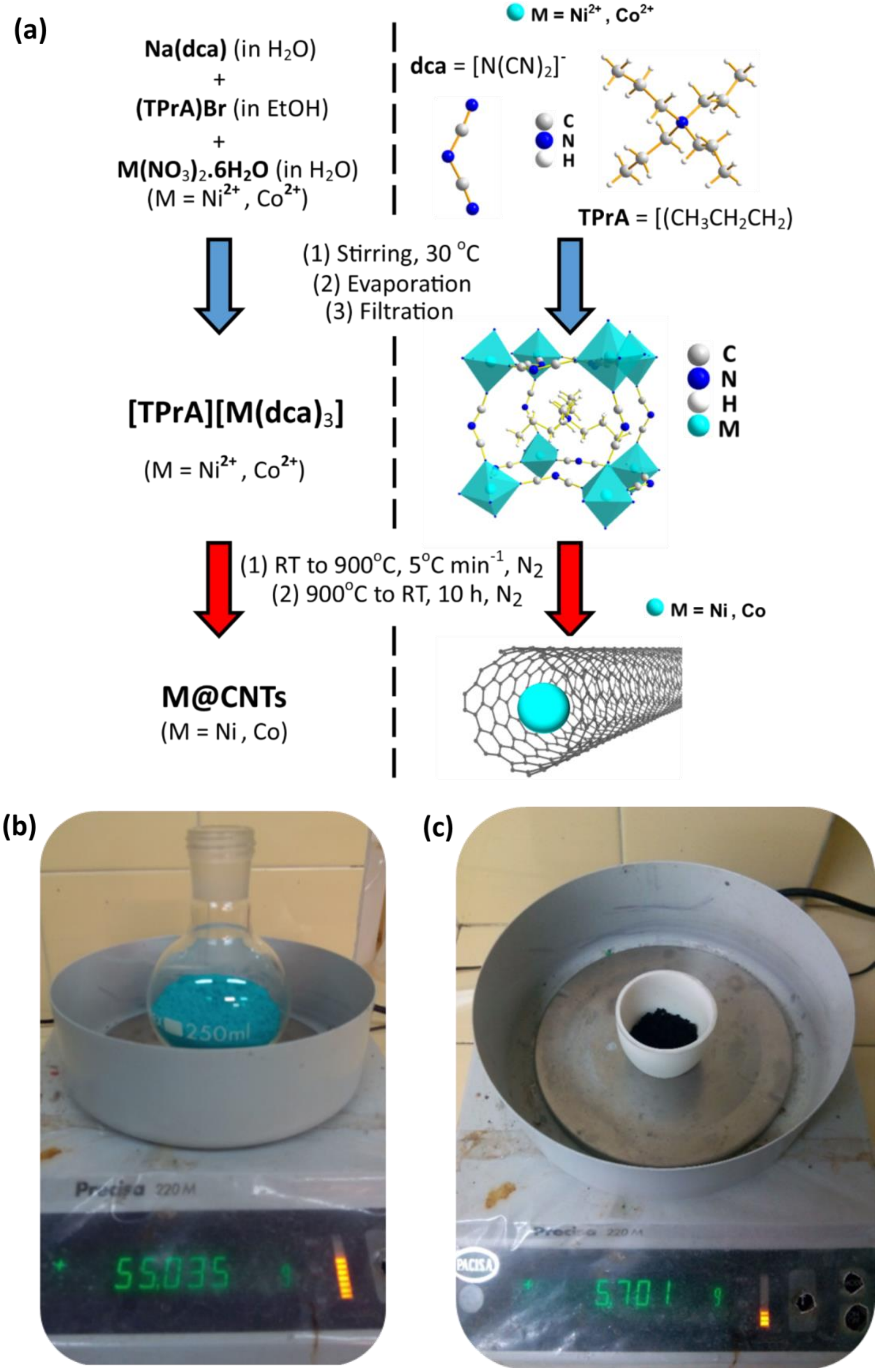

Figure S1. (a) Scheme of the synthesis of [TPrA][M(dca)$_3$] powder and the M@CNTs. (b) [TPrA][Ni(dca)$_3$] powder obtained by the here presented method with a yield of ~ 95%. (c) Ni@CNTs powder obtained by direct calcination of 35 g of [TPrA][Ni(dca)$_3$] precursor at 900 °C.

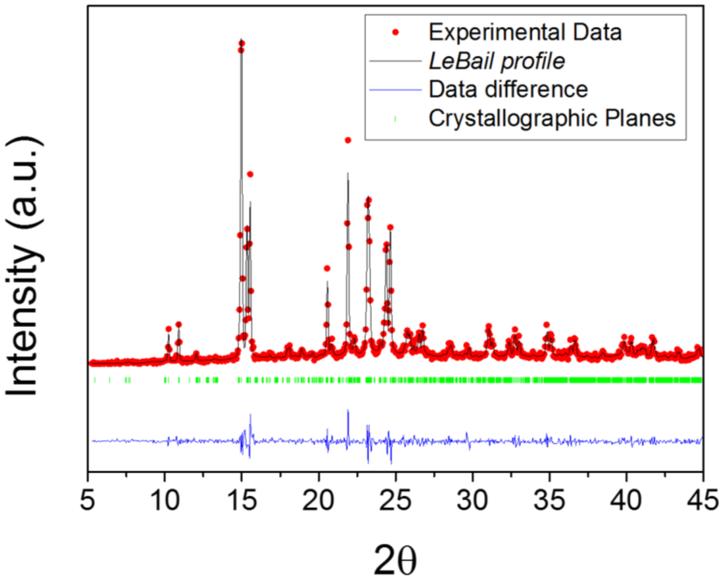

Figure S2. Le Bail refinement of the room temperature PXRD pattern of the [TPrA][Co(dca)$_3$] compound. Observed (red dots), calculated (black solid line) and difference (blue solid line at the bottom) profiles. The tick green marks indicate the positions of the allowed Bragg reflections.

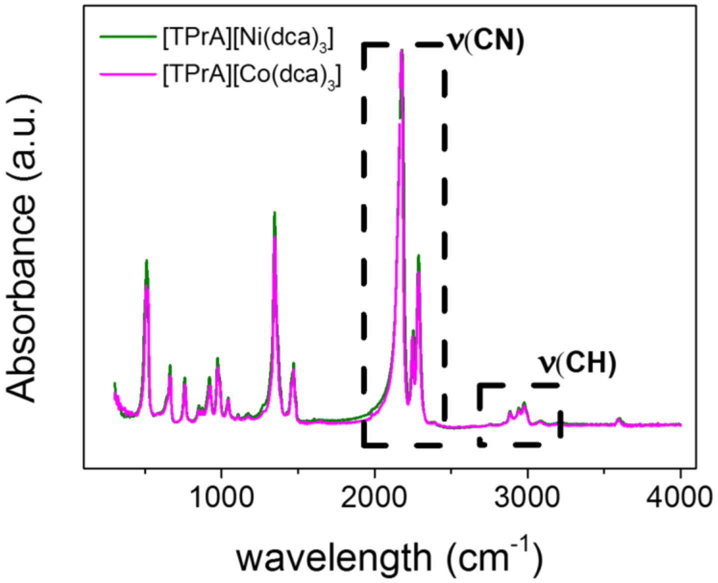

Figure S3. FT-IR spectra of [TPrA][M(dca)$_3$] where M = Ni^{2+} (green) and Co^{2+}(pink). The IR bands between 2000 cm^{-1} and 2360 cm^{-1}are related to the dicyanamide ligand ν(CN) bands: 2286 cm^{-1}vs (C≡N), 2230 cm^{-1}vas(C–N) + ns(C–N), 2175 cm^{-1}vas (C≡N), and the region between 2800 cm^{-1}and 3200 cm^{-1} correspond to C-H stretching bands of the tetrapropylammonium cations.

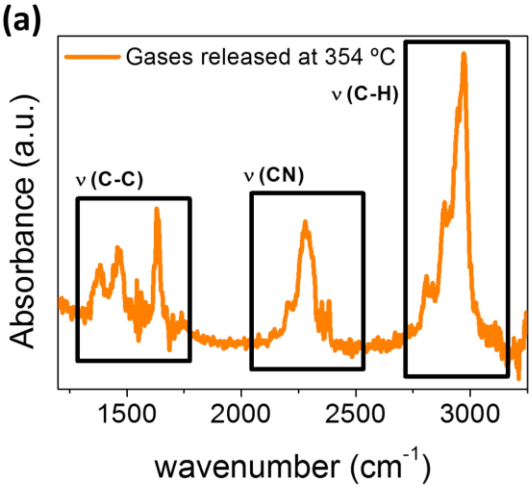

Figure S4. FT-IR spectra of the gases released during the thermal decomposition of the precursor [TPrA][Ni(dca)$_3$]: (a) at 354 °C, (b) at 500 °C. ν(CN) represent both ν(C N) and ν(C≡N). Graphic (a) is representative for the behaviour during the two first weight losses: the IR bands related to dca ligands (ν(CN) = ν(C-N) + ν(C≡N)) and TPrA cations (ν(C-C) and ν(C-H)) are observed. Graphic (b) is representative for the third and fourth weight losses: only the dca ligand bands remain, and their intensity decreases as temperature increases.

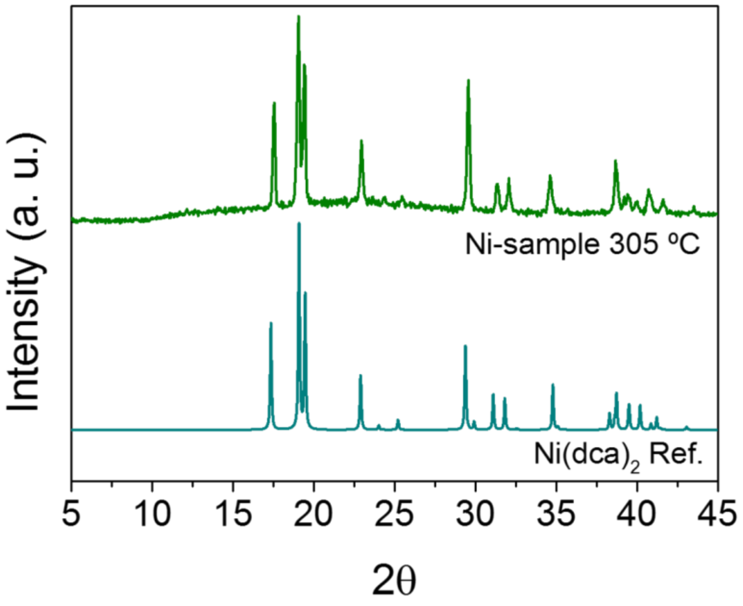

Figure S5. PXRD pattern of the [TPrA][Ni(dca)$_3$] precursor material annealed at 305 °C compared to that of the Ni(dca)$_2$ sample reported in Ref.: J. L. Manson, *et al. Chem. Mater.* 1998, **10**, 2552.

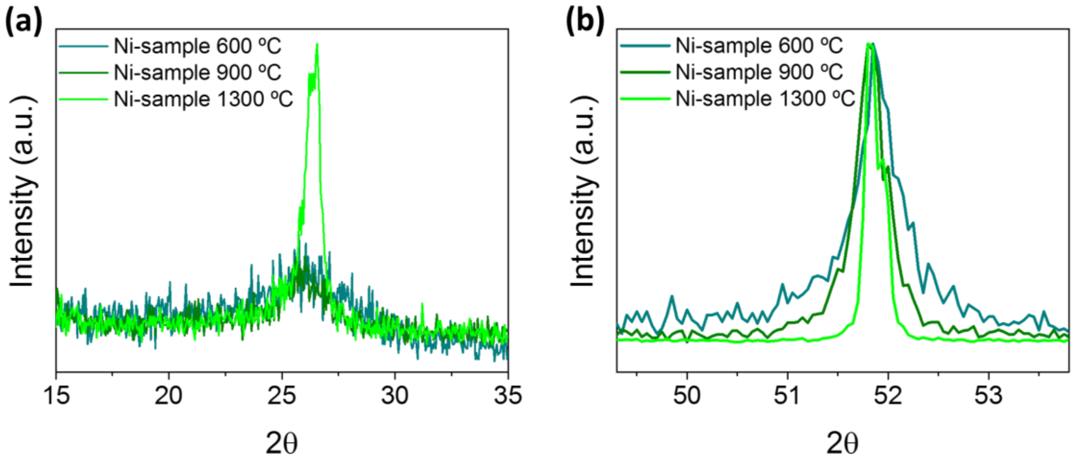

Figure S6. (a) Comparison of the graphite peak (26.3 °2θ) for the Ni-sample annealed at different temperatures (600 °C, 900 °C and 1300 °C), with absolute intensities. (b) Comparison of the metallic Ni peak (51.9 °2θ) for the Ni-sample annealed at different temperatures (600 °C, 900 °C and 1300 °C), with normalized intensities for a better comparison of the peak shape.

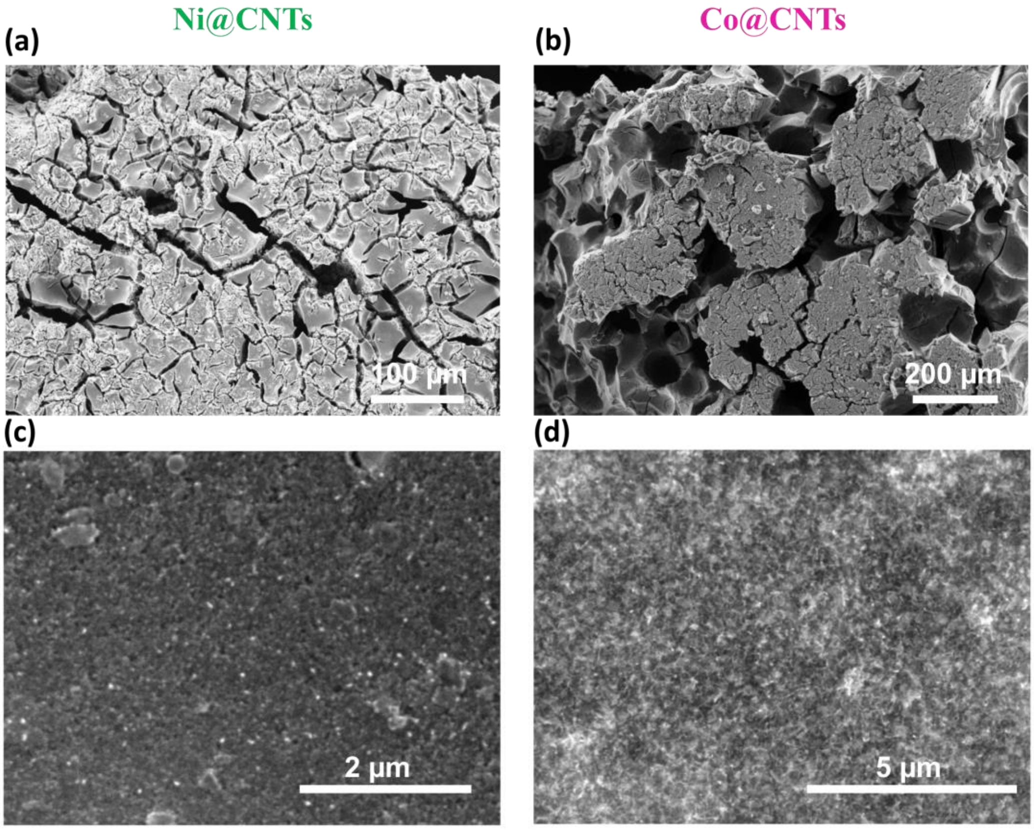

Figure S7. Aspect of the M@CNTs samples after the annealing at 900 ˚C as seen by scanning electron microscopy.

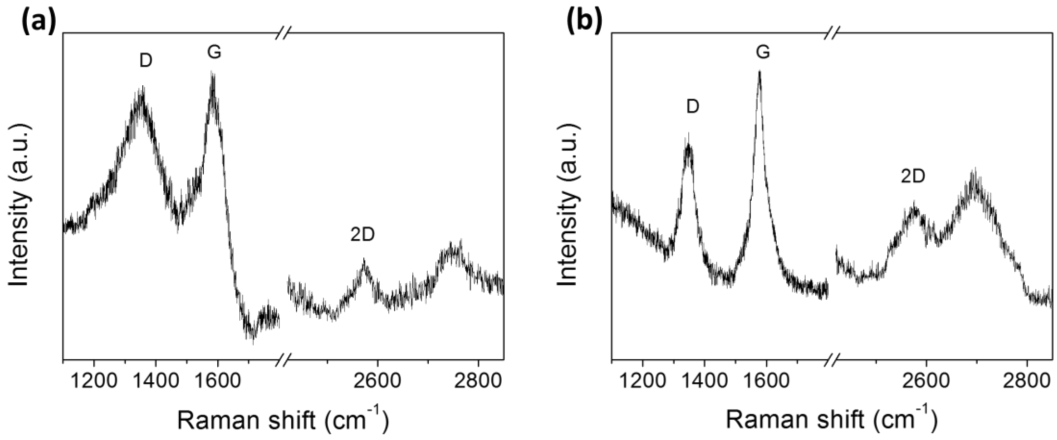

Figure S8. Raman spectra of the samples (a) Ni@CNTs and (b) Co@CNTs.

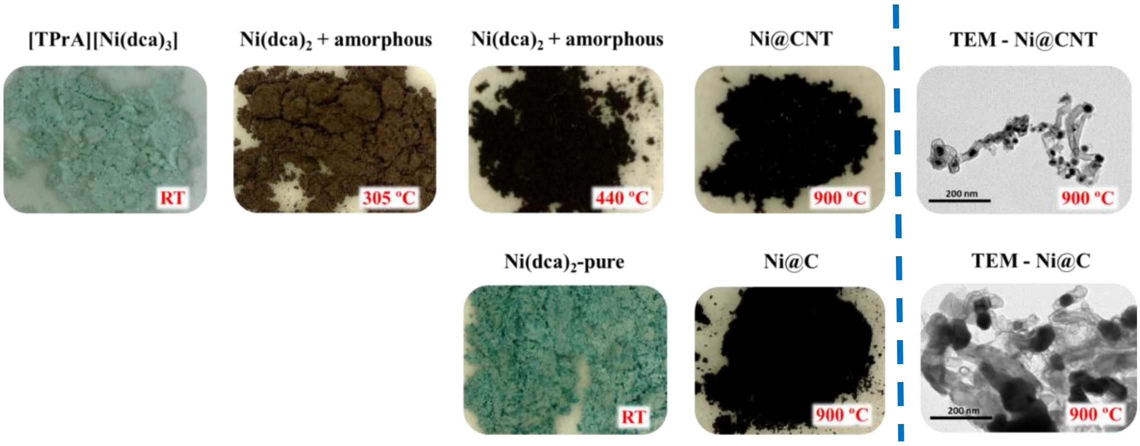

Figure S9. Aspect of the Ni(dca)$_2$-pure and [TPrA][Ni(dca)$_3$] samples, at RT and after annealing at different temperatures, as seen by optical microscopy (on the left of the blue line) and by transmission electron microscopy (on the right of the blue line).

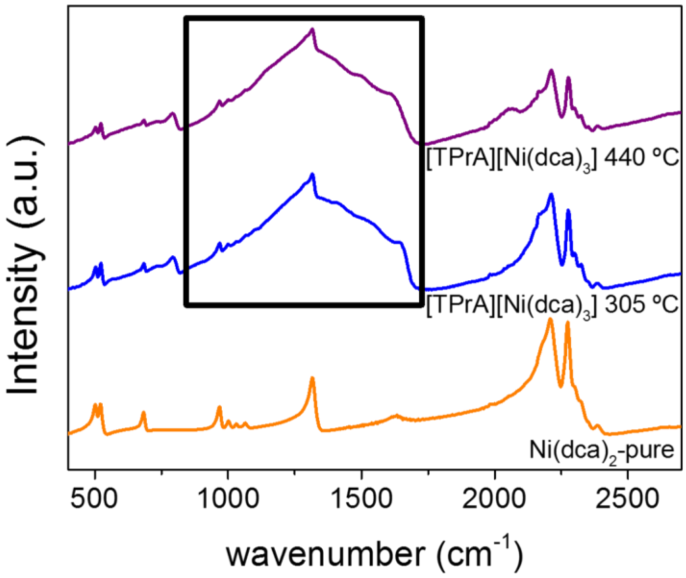

Figure S10. FT-IR spectra of Ni(dca)$_2$-pure (synthesized according to the method described in reference J.L. Manson *et al. Chem. Mater.* 1998, **10**, 2552) and the product obtained from [TPrA][Ni(dca)$_3$] annealed at 305 °C and 440 °C, respectively.

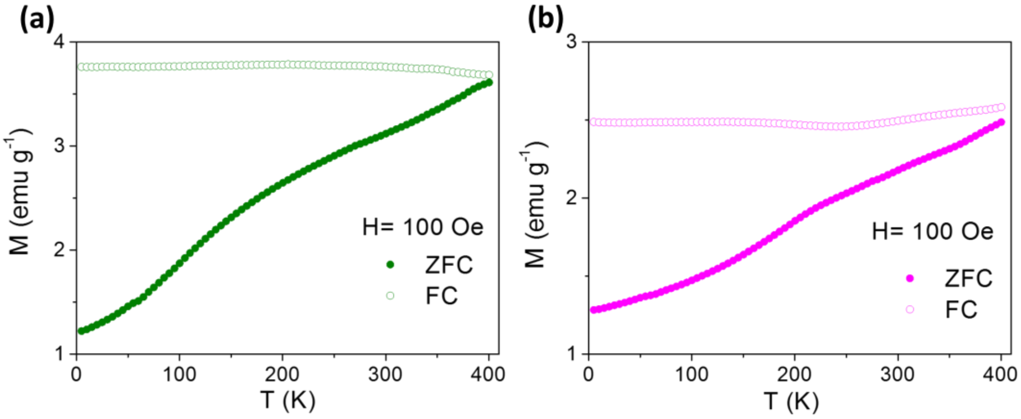

Figure S11. Zero-field-cooled (ZFC) and field-cooled (FC) (H= 100 Oe) magnetization curves of (a) Ni@CNT (green) and (b) Co@CNT (pink) obtained at 900 ^{o}C**.**

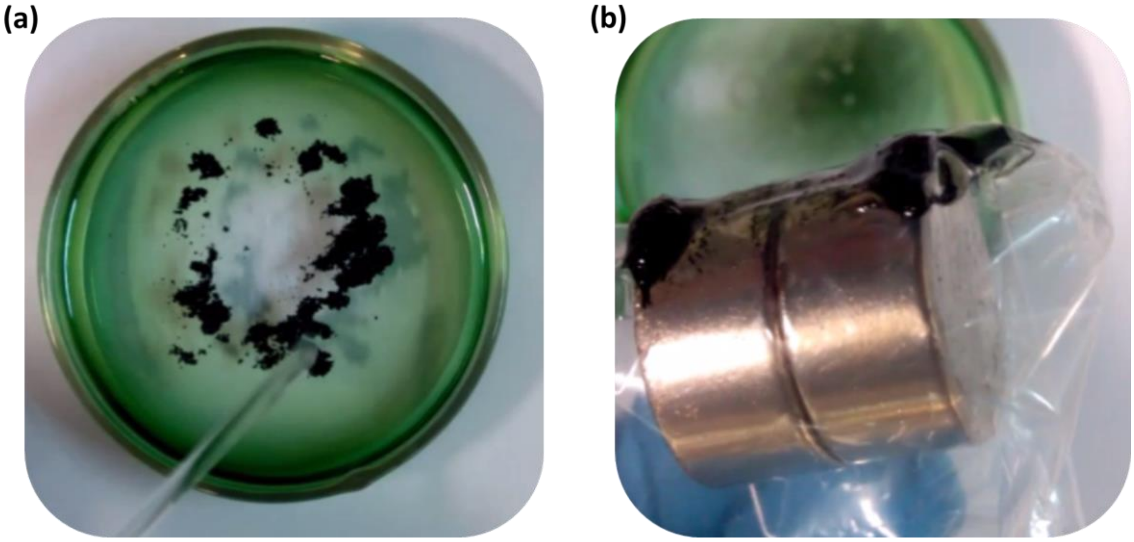

Figure S12. (a) M@CNT materials spilled on top of oil-water sample and (b) recovery of M@CNTs with oil adsorbed, using a magnet.

Table S1. IR stretching bands of the [TPrA][M(dca)$_3$] (M = Ni^{2+} and Co^{2+}) compounds.

[TPrA][M(dca)$_3$] IR bands	wavenumber (cm^{-1})
vs(C≡N)	2286
vas(C–N) ns(C–N)	2230
vas(C≡N)	2175
(C-H)	2800 – 3200

Table S2. Comparison of the elemental composition of the precursor [TPrA][M(dca)$_3$] compounds (calculated from the nominal formula) and the samples obtained after their annealing at 900 °C (expressed both as % relative and normalized) as obtained from TGA data. Last column: results from the elemental analysis (E.A.) of C, N and H.

		Precursor [TPrA][M(dca)$_3$]	Annealed at 900 °C (Relative)	Annelaed at 900 °C (Norm.)	E.A.
Ni Comp.	Ni(%)	13.24 %	13.24 %	79.90 %	
	C (%)	48.78 %	3.33 %	20.10 %	19.83 %
	N (%)	31.61 %			1.09 %
	H (%)	6.37 %			< 0.1 %
Co Comp.	Co(%)	13.29 %	13.29 %	55.08 %	
	C (%)	48.76 %	10.84 %	44.92 %	38.93 %
	N (%)	31.59 %			1.26 %
	H (%)	6.36 %			< 0.1 %

Table S3. Elemental analysis of Ni(dca)$_2$-pure (synthesized according to the literature: J. L. Manson *et al. Chem. Mater.* 1998, **10**, 2552) and the product obtained from the annealing of [TPrA][Ni(dca)$_3$] at 305 °C and 440 °C.

	% N	% C	% H	% Total (CNH)
Ni(dca)$_2$-pure RT	40,99	23,66	0,54	65,18
[TPrA][Ni(dca)$_3$] 305 °C	38,22	33,75	2,42	74,38
[TPrA][Ni(dca)$_3$] 440 °C	34,88	26,40	1,77	63,05