

Article

Novel Magnetic Nanohybrids: from Iron Oxide to Iron Carbide Nanoparticles Grown on Nanodiamonds

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Supplementary Materials

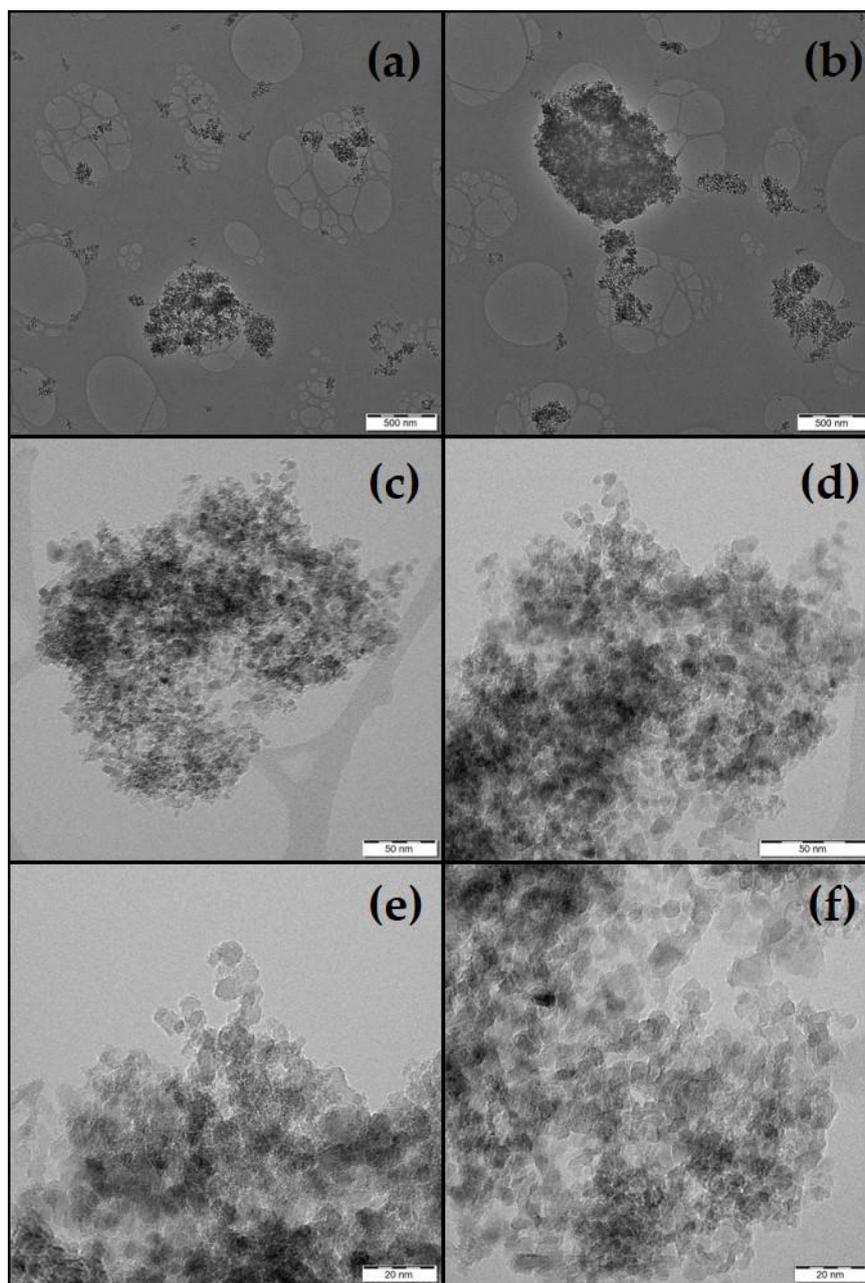


Figure S1. TEM images of the CP sample.

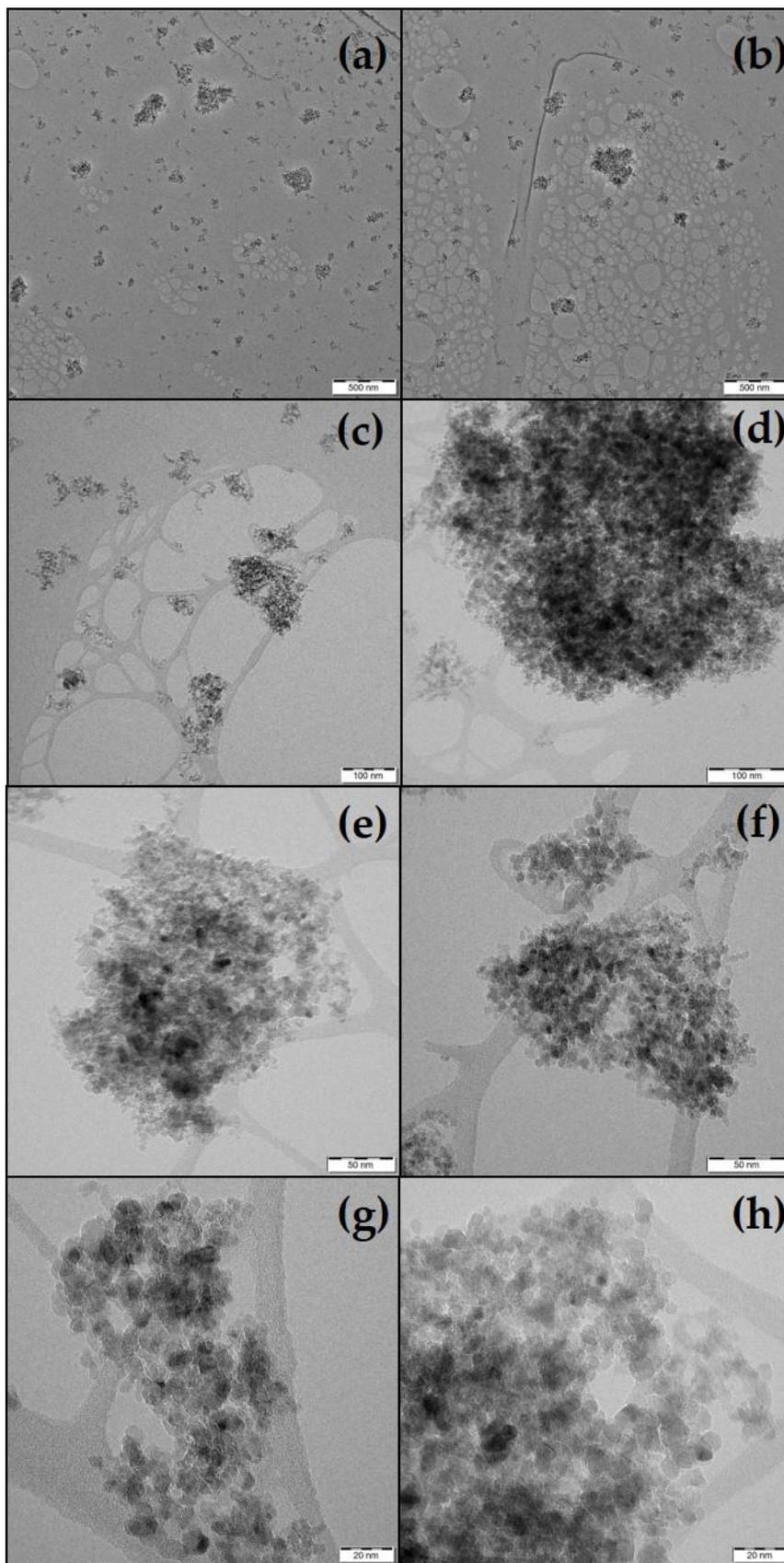


Figure S2. TEM images of the NHD-600 sample.

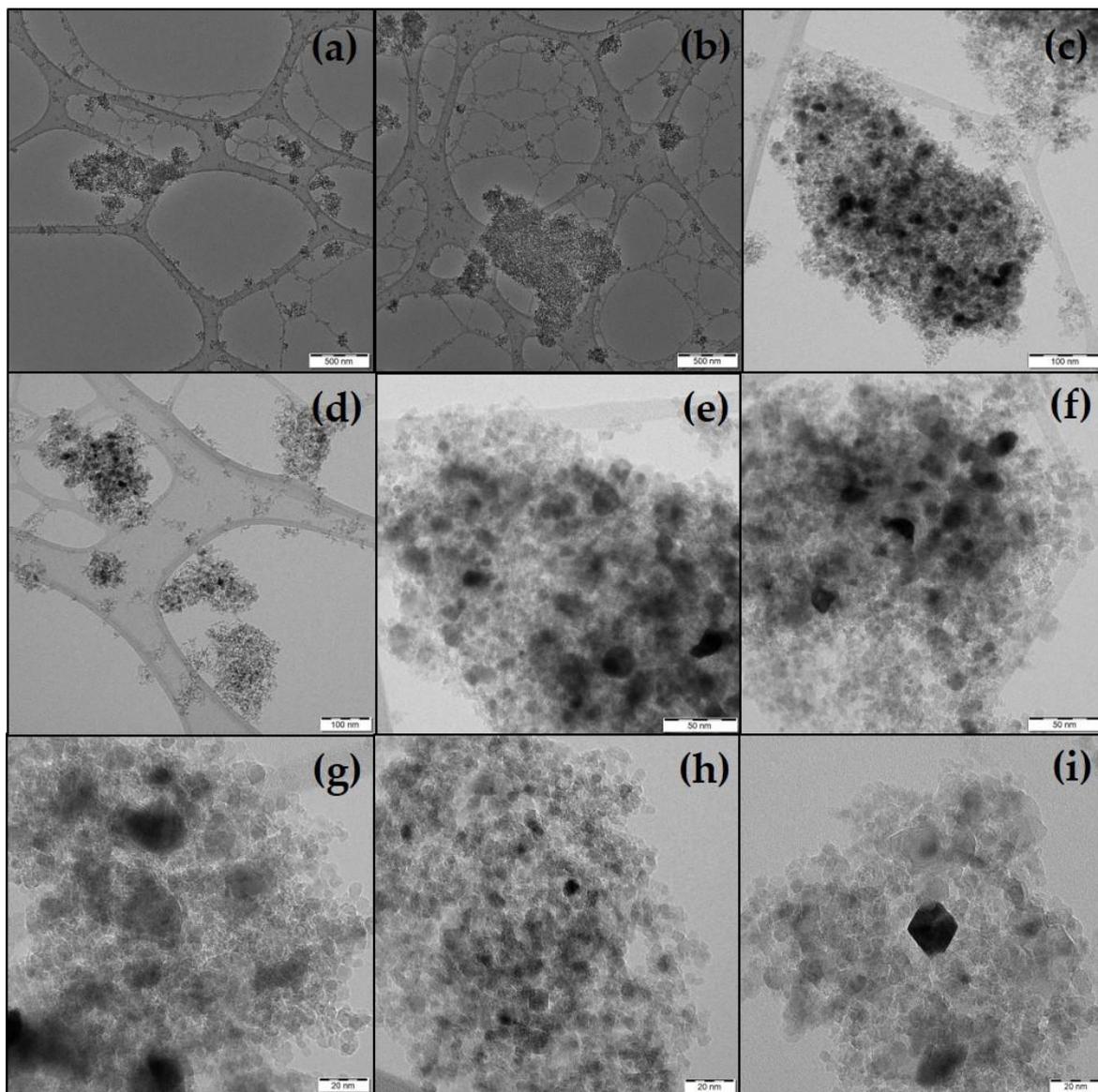
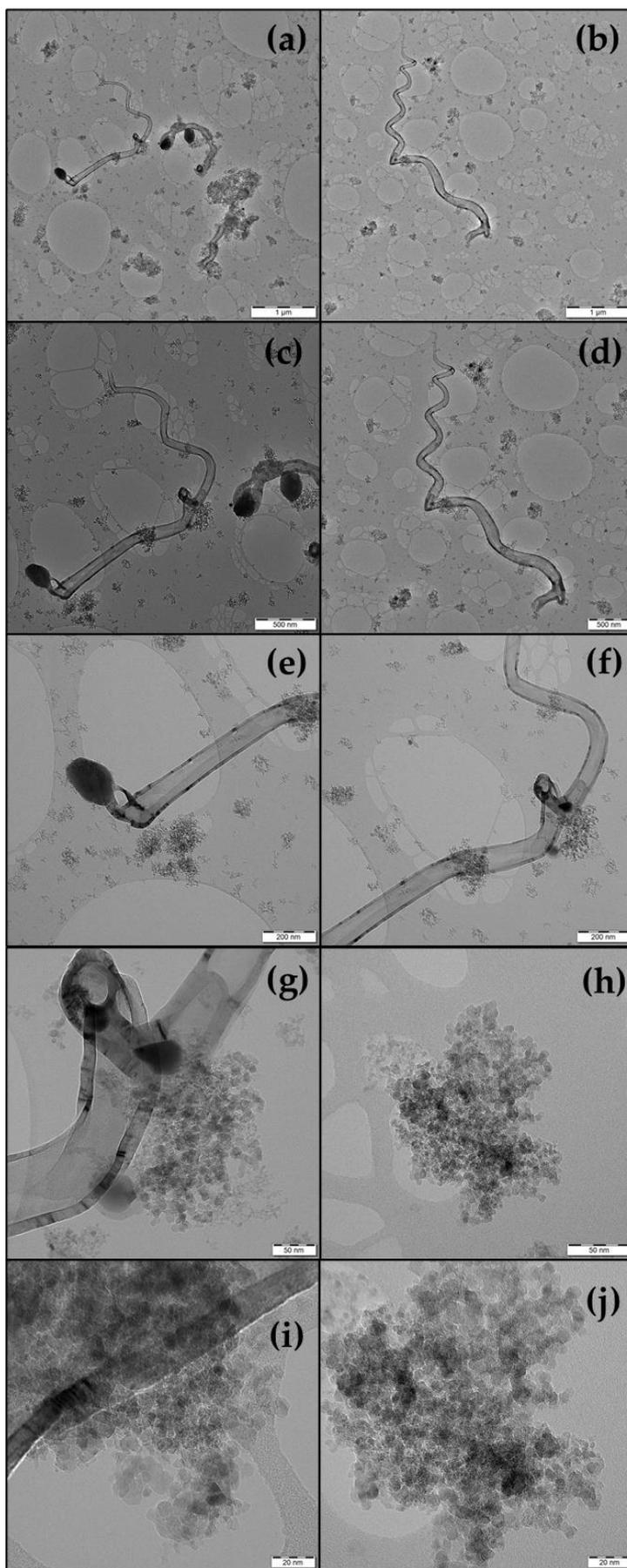


Figure S3. TEM images of the NHD-750 sample.



FigureS4. TEM images of the NHD-900 sample.

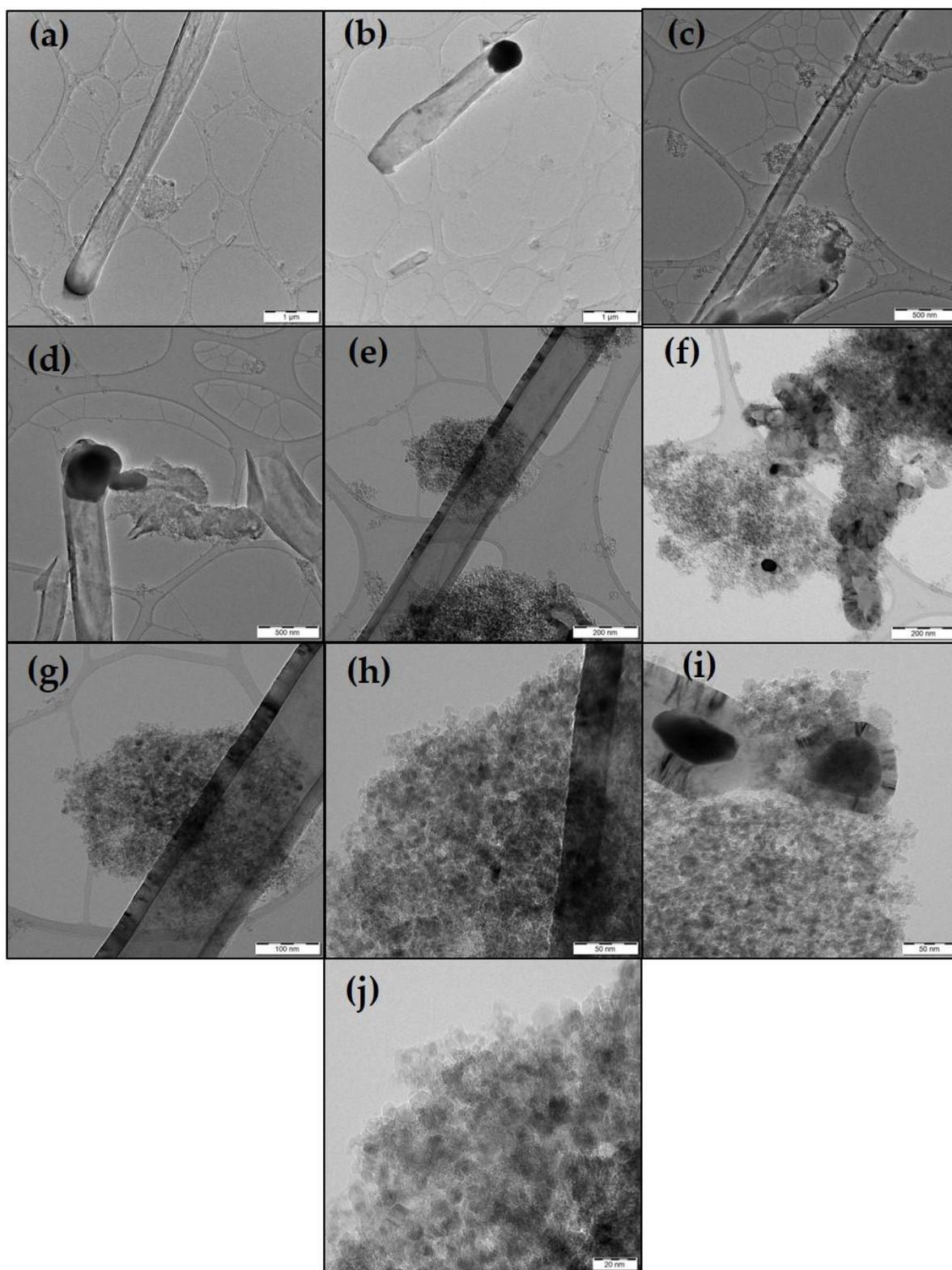


Figure S5. TEM images of the NHD-1050 sample.

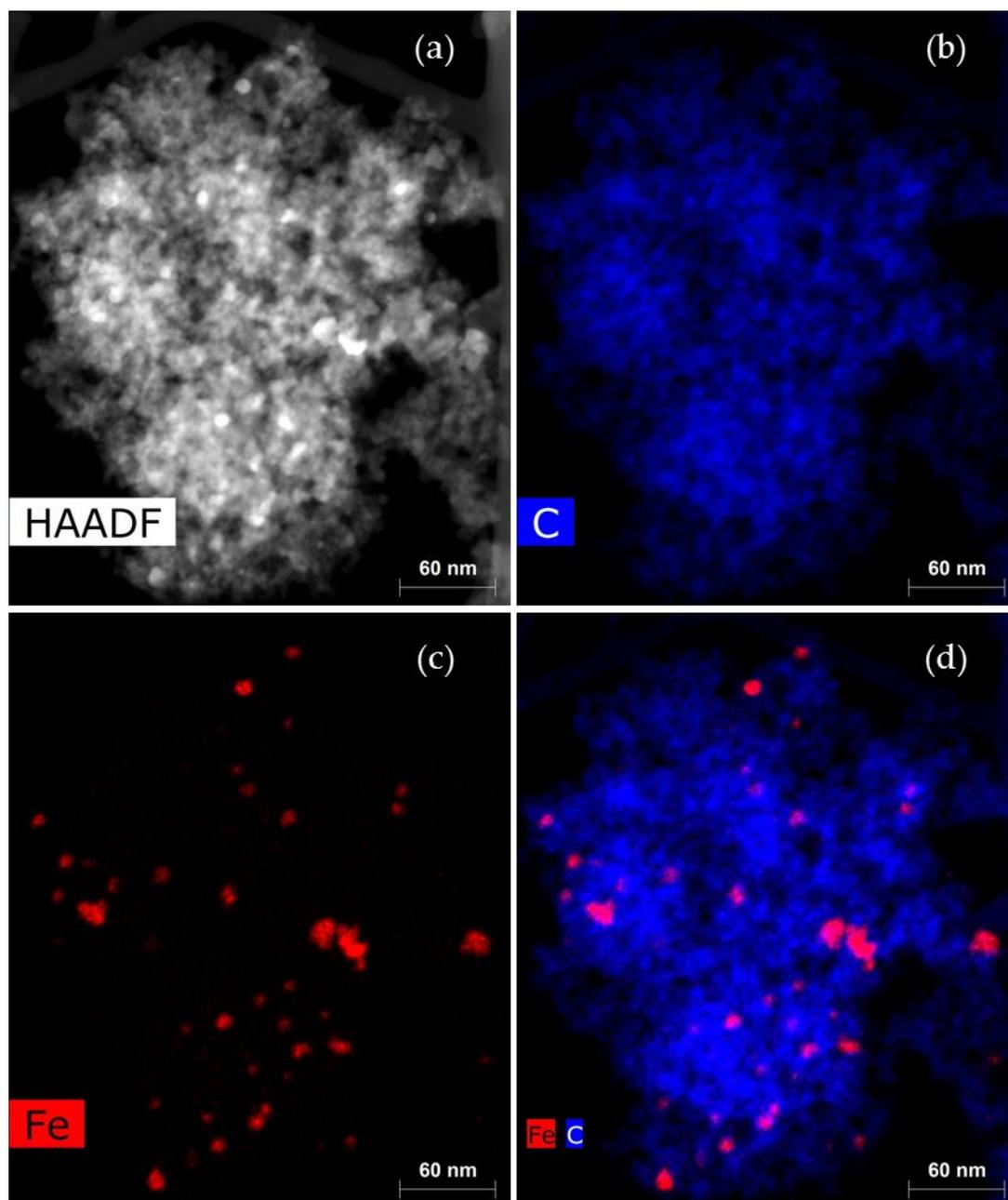


Figure S6. HAADF image from a certain NT cluster of the NHD-750 sample with specific elemental mapping.

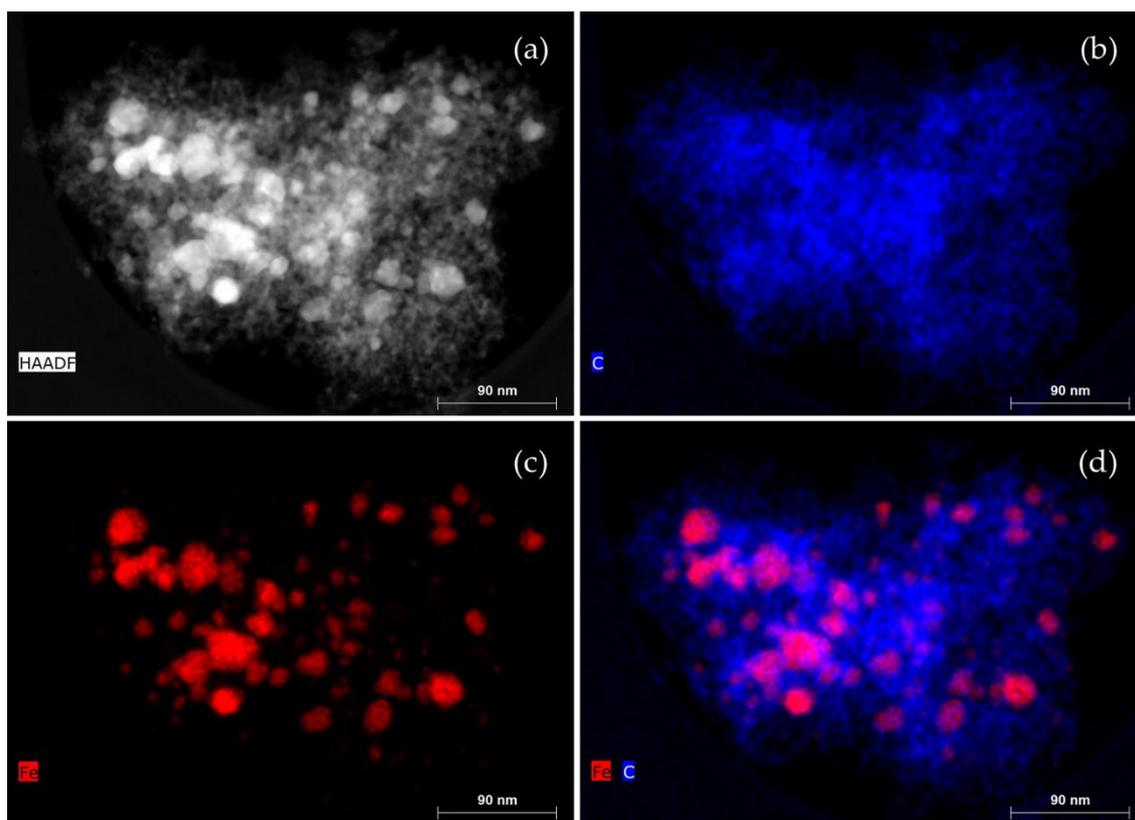


Figure S7. HAADF image from a certain NT cluster of the NHD-900 sample with specific elemental mapping.

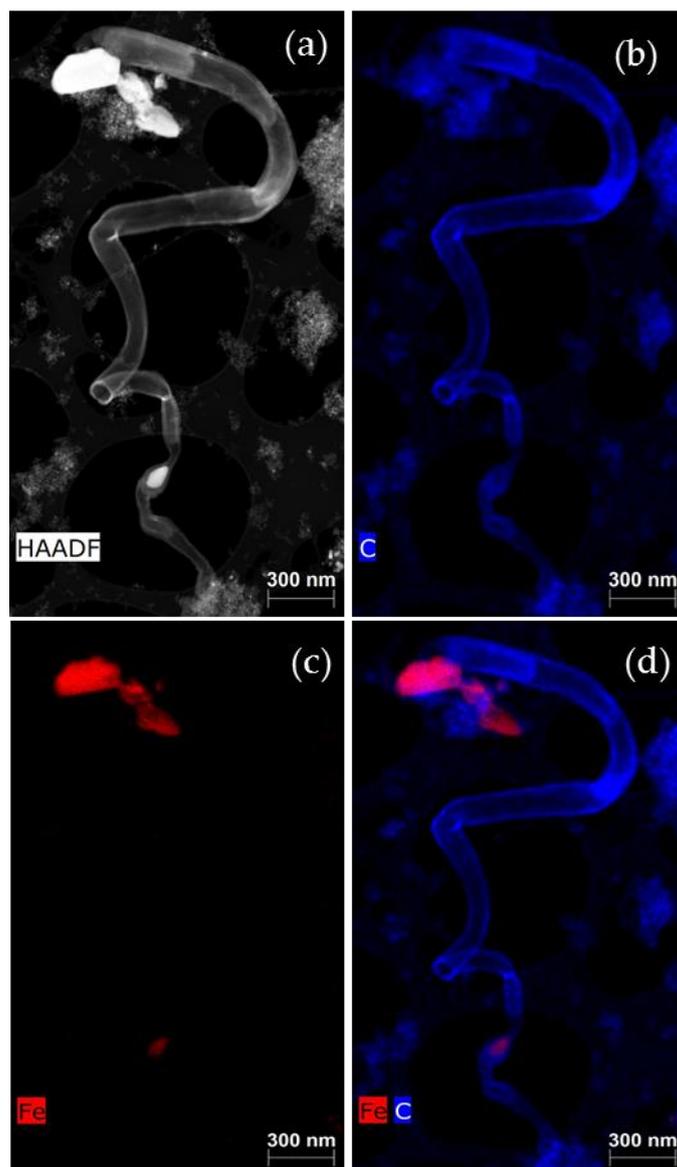


Figure S8. HAADF image from a certain portion of the NHD-900 sample including NDs NTs and CNTs with specific elemental mapping.

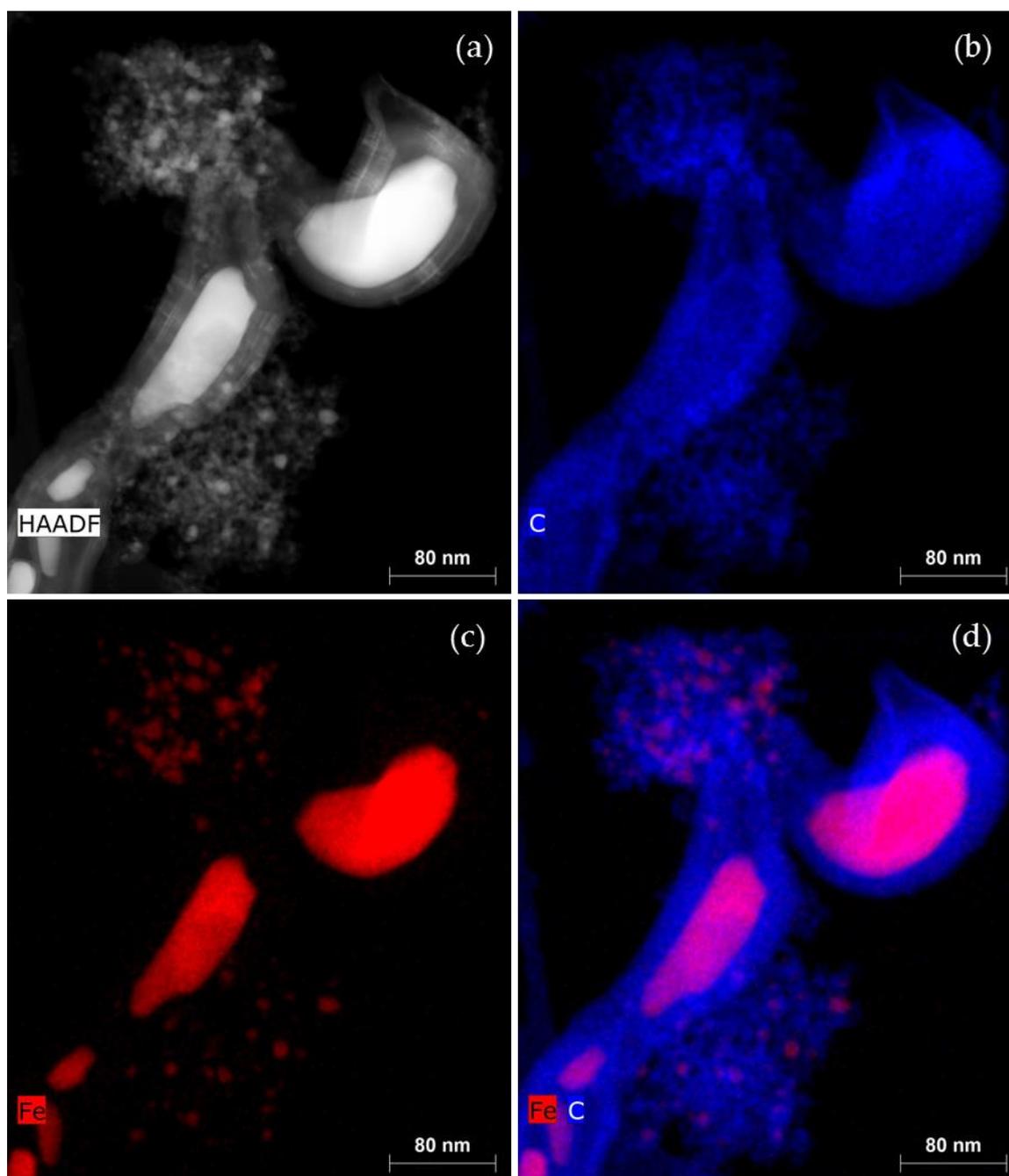


Figure S9. HAADF image from a certain portion of the NHD-900 sample including NDs NTs and CNTs with specific elemental mapping.

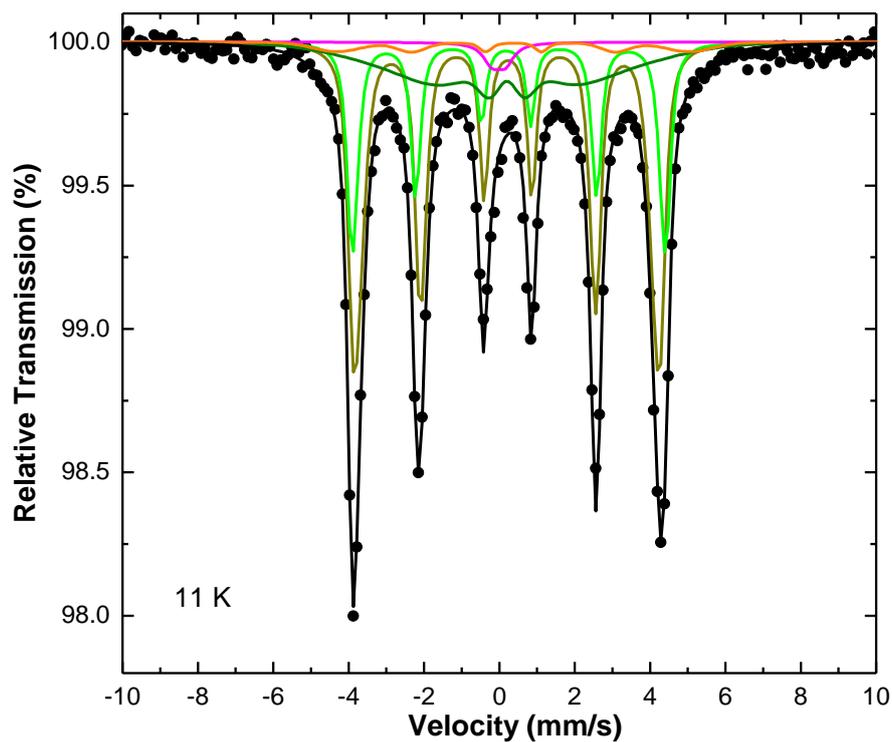


Figure S10. Mössbauer spectrum of the NHD-750 sample recorded at 11K.

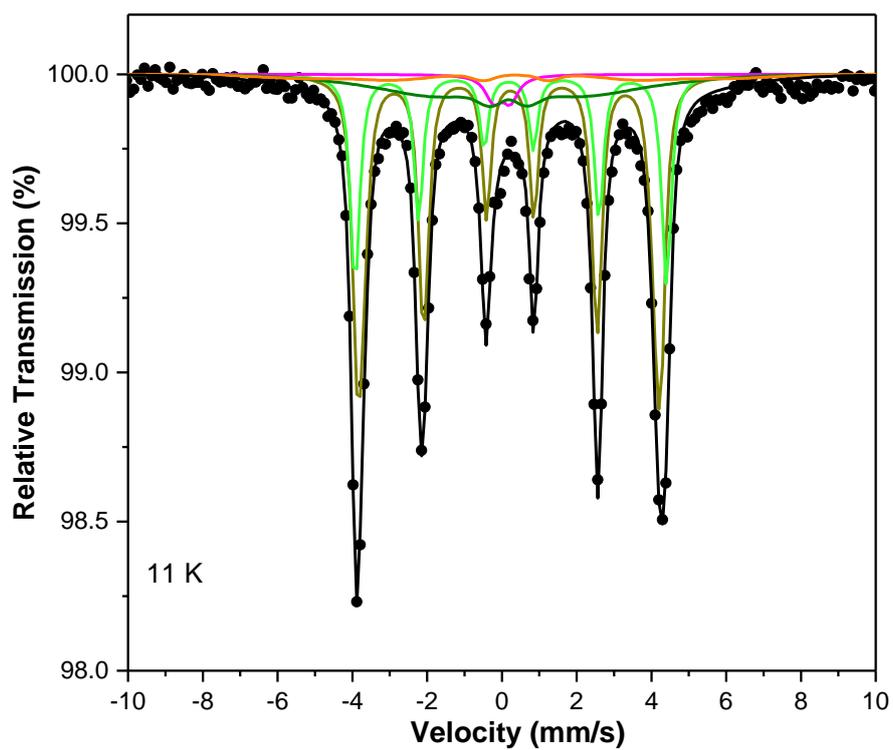


Figure S11. Mössbauer spectrum of the NHD-900 sample recorded at 11 K.

Table S1. Mössbauer Parameters as resulting from the best fits of the MS of all samples recorded at 77 K. Component colors (CL): BU=blue, C=cyan, DY=dark yellow, G=gray, GR=green, LG=light gray, LM=light magenta, M=magenta, O=orange, OL=olive, R=red, W=wine, V=violet.

Sample	Component Assignment	IS (mm/s)	$\Gamma/2$ (mm/s)	QS or 2ε (mm/s)	B_{hf} (kOe)	ΔB_{hf} (kOe)	Area (%)	CL
CP	SPM γ -Fe ₂ O ₃	0.47	0.21	0.95	0	0	66	O
	MRES γ -Fe ₂ O ₃	0.47	0.14	0.00	427	63	10	LG
	MCOL γ -Fe ₂ O ₃	0.47	0.14	0.00	208	99	24	W
NHDs-600	γ -Fe ₂ O ₃ /Fe _{3-x} O ₄ (Fe ³⁺)	0.44	0.15	0.00	500	8	14	G
	SPM γ -Fe ₂ O ₃	0.48	0.45	1.03	0	0	30	O
	MRES Fe _{3-x} O ₄	0.56	0.15	0.00	527	51/3*	44	LM
	MCOL Fe _{3-x} O ₄	0.56	0.24	0.00	193	42	12	R
NHDs-750	Fe ₃ C (1)	0.31	0.14	-0.04	252	6/0*	49	DY
	Fe ₃ C (2)	0.33	0.14	0.06	256	3/0*	26	GR
	MCOL Fe ₃ C	0.32	0.14	0.04	150	94	20	OL
	SPM metallic Fe	0.08	0.26	0.32	0	0	2	M
	MCOL Fe ³⁺ (IO)	0.47	0.14	-0.01	251	45	3	O
NHDs-900	Fe ₃ C (1)	0.31	0.14	-0.04	250	5/0*	52	DY
	Fe ₃ C (2)	0.34	0.14	0.05	255	2/0*	28	GR
	MCOL Fe ₃ C	0.33	0.14	0.07	163	86	13	OL
	SPM metallic Fe	0.08	0.26	0.35	0	0	3	M
	MCOL Fe ³⁺ (IO)	0.47	0.14	-0.01	304	83	4	O
NHDs-1050	Fe ₃ C (1)	0.32	0.14	-0.04	249	5/0*	32	DY
	Fe ₃ C (2)	0.34	0.14	0.05	255	2/0*	15	GR
	MCOL Fe ₃ C	0.33	0.14	0.01	93	45	9	OL
	MCOL Fe ³⁺ (IO)	0.47	0.14	0.01	295	77	10	O
	Fe ₅ C ₂ (1)	0.39	0.15	0.13	246	6	14	V
	Fe ₅ C ₂ (2)	0.33	0.14	0.00	207	9	13	B
	Fe ₅ C ₂ (3)	0.33	0.14	0.00	118	13	6	C
	SPM IC	0.20	0.17	0.37	0	0	1	M

Table S2. Mössbauer Parameters as resulting from the best fits of the MS of the NHD-750 and NHD-900 samples recorded at 11 K. Component colors(CL): DY=dark yellow, GR=green, M=magenta, O=orange, OL=olive.

Sample	Component Assignment	IS (mm/s)	$\Gamma/2$ (mm/s)	QS or 2ε (mm/s)	B_{hf} (kOe)	ΔB_{hf} (kOe)	Area (%)	CL
NHDs-750	Fe ₃ C (1)	0.32	0.14	-0.04	258	6/0*	48	DY
	Fe ₃ C (2)	0.32	0.14	0.07	263	3/0*	25	GR
	MCOL Fe ₃ C	0.33	0.14	0.04	173	98	21	OL
	SPM metallic Fe	0.09	0.26	0.36	0	0	2	M
	MRES Fe ³⁺ (IO)	0.48	0.14	-0.01	291	35	4	O
NHDs-900	Fe ₃ C (1)	0.31	0.14	-0.04	256	5/0*	52	DY
	Fe ₃ C (2)	0.32	0.14	0.05	261	2/0*	28	GR
	MCOL Fe ₃ C	0.33	0.14	0.07	192	120	16	OL
	SPM metallic Fe	0.11	0.26	0.45	0	0	3	M
	MCOL Fe ³⁺ (IO)	0.48	0.14	-0.01	339	83	5	O