Structure and magnetic properties CNT decorated by FeNi CoFe nanoparticles

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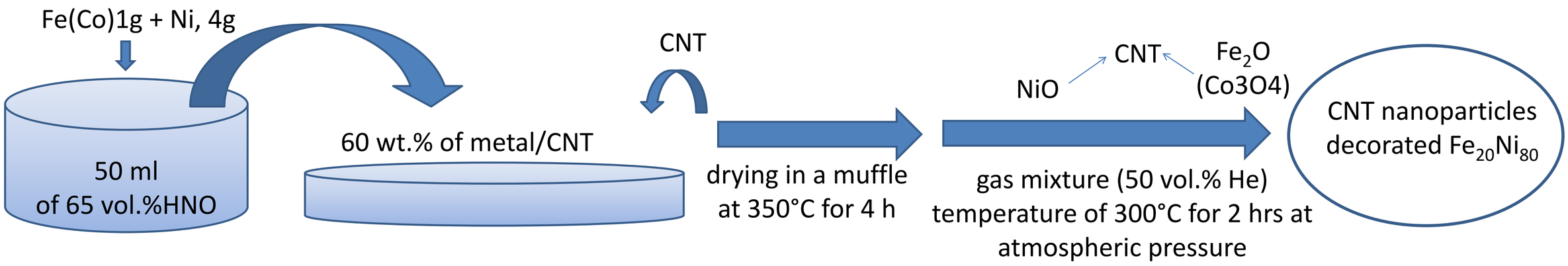
•Aim

Integrating of nanoscale magnetic alloys FeNi Co93Fe07 with nanocarbon will combine the excellent properties of both of them into one nanosystem which promises many practical applications in future nanotechnology The aim of this study was to experimentally investigate the effect CNT decoration by FeNi Co93Fe07 Ni20Co80 on structural and magnetic properties of Co93Fe07(CNT) ,Ni80Fe20(CNT) (Ni20Co80)CNT composites.

•Methods



•X-ray structure

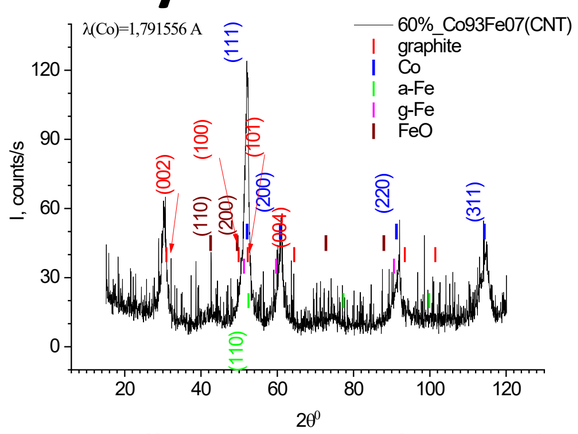


Fig. 1. Diffraction spectrum of nanopowder

•Morphology

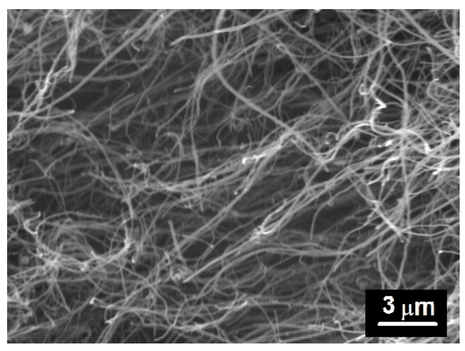


Fig. 2. SEM image of the source CNT

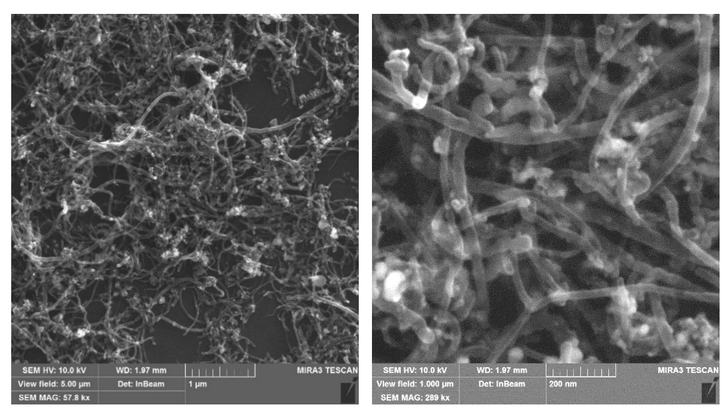


Fig. 3. SEM image 60 wt. % $Co_{93}Fe_{07}$(CNT)

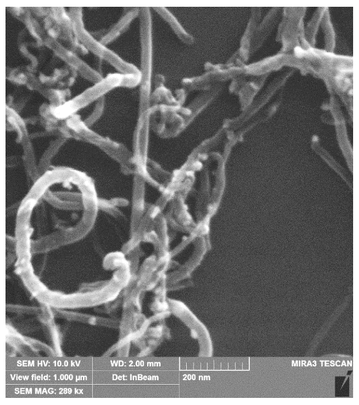


Fig. 4. SEM image 20 wt. % $Ni_{20}Co_{80}$(CNT)

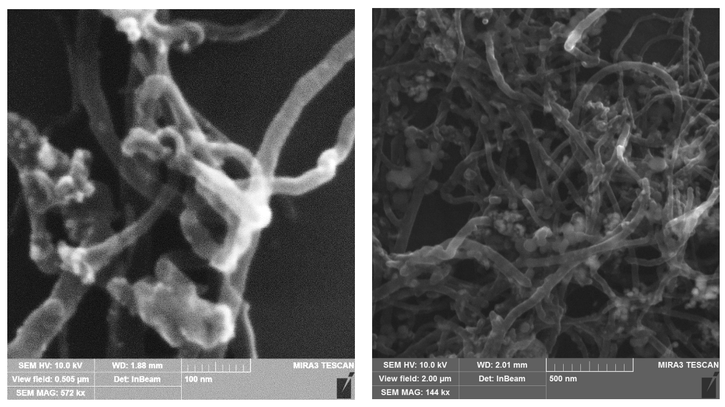


Fig. 5. SEM image 60 wt. % $Ni_{80}Fe_{20}$(CNT)

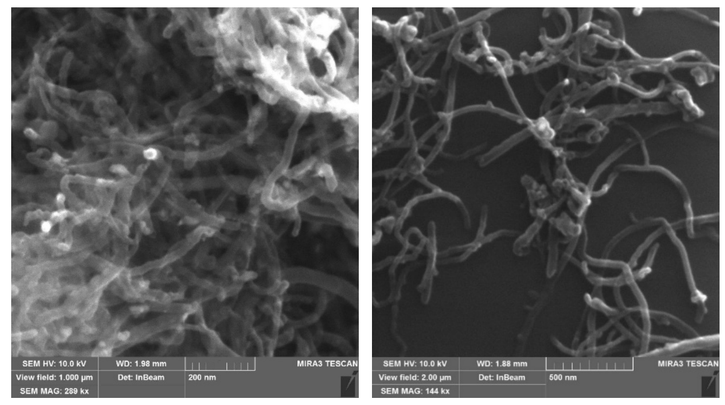


Fig. 6. SEM image 20 wt. % $Ni_{80}Fe_{20}$(CNT)

•Magnetic properties

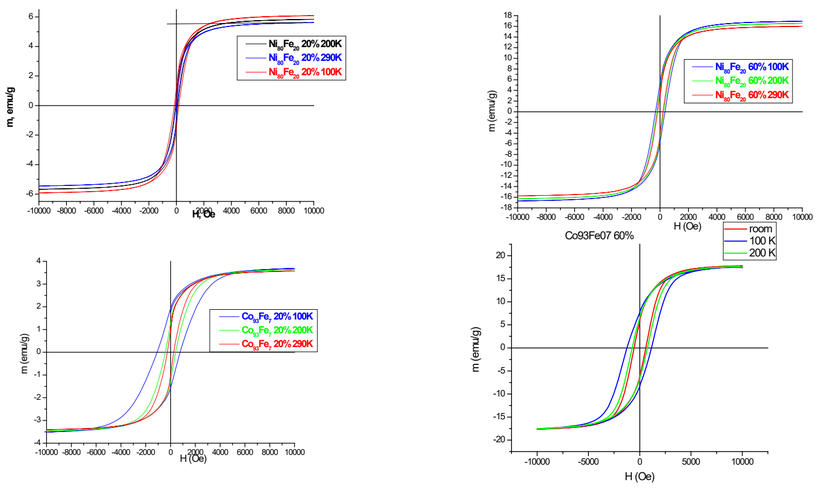
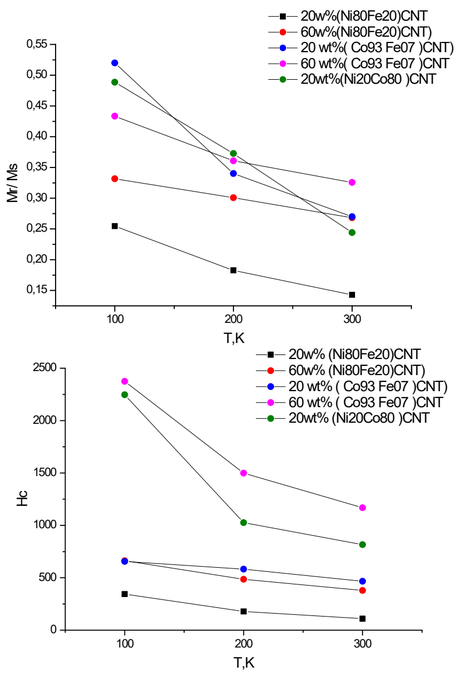


Fig. 7. Hysteresis loops (60 wt. % of metal component per CNT) at different temperatures



Samples	T, K	Ms	Mr	Hc	Mr/ Ms
20 w%($Ni_{80}Fe_{20}$)CNT	300	5,62	0,37	109,6	0,143
	200	5,85	0,67	178,58	0,18278
	100	6,1	1,2	344,4	0,25464
60 wt%($Ni_{80}Fe_{20}$)CNT	300	15,97	3,42	379,1	0,26835
	200	16,53	4,11	485,6	0,30074
	100	16,98	5,30	662,4	0,33154
20 wt%($Co_{93}Fe_{07}$)CNT	300	3,57	0,94	466,7	0,27
	200	3,63	1,27	581,9	0,34
	100	3,68	1,98	655,91	0,52
60 wt%($Co_{93}Fe_{07}$)CNT	300	17,5	5,70	1169	0,32571
	200	17,6	6,35	1499	0,3608
	100	17,7	7,67	2375	0,43333
20 wt%($Ni_{20}Co_{80}$)CNT	300	4,71	1,15	816	0,24416
	200	4,75	1,77	1026	0,37263
	100	4,77	2,33	2247	0,48847

Fig. 8. Temperature dependences of saturation magnetization (Ms), saturation field (Hs), remanent magnetization (Mr) temperature dependences of coercivity (HC), squareness (Mr/Ms) of GNP-$Fe_{20}Ni_{80}$ particles

•Conclusion

- The method of impregnating of the carrier with a solution of salts of active catalyst mass for synthesis of CNT decoration by $Fe_{20}Ni_{80}$ ($Co_{93}Fe_{07}$,$Ni_{20}Co_{80}$)was successfully applied and the obtained composite contains 20 (60)wt. % of metal component. Structurally and morphological studies have shown that the metal phase is mostly distributed on the surface of carbon nanotubes average size of metal particles is 20 – 40 nm which are well distributed on the surface of CNT.
- The results of investigations of magnetic properties of CNT decoration by FeNi ($Co_{93}Fe_{07}$,$Ni_{20}Co_{80}$)confirmed that metals are small single-domain, randomly oriented assembly of spherical (or close to spherical) particles on the CNT surface. Temperature dependences of the main magnetic parameters of the CNT-$Fe_{20}Ni_{80}$ particles which were extracted from magnetization curves(hysteresis loops) indicated that, the saturation magnetization of CNT decoration by $Fe_{20}Ni_{80}$ ($Co_{93}Fe_{07}$,$Ni_{20}Co_{80}$)weakly depends on temperature while coercive field Hc essentially increase under content of metal phase on the CNT surface and temperature decrease.