Supplementary Materials

Tuning Dielectric Loss of SiO_2@CNTs for Electromagnetic Wave Absorption

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EXPERIMENTAL SECTION

Structure Characterizations

The magnetic property of NCNTs samples were measured by a vibrating sample magnetometer (VSM; Lakeshore 7410, Columbus, USA) at room temperature.

Electromagnetic parameter measurement

The electromagnetic wave absorption properties of the absorbing materials were measured by using a vector network analyzer (Anritsu MS4644A Vectorstar) in the 2−18 GHz range at the room temperature. The cylindrical sample (with the inner diameter and outer diameter are 3.04 mm and 7.00 mm respectively, and 3.00 mm thickness) was prepared by mixing absorbing materials with paraffin matrix was controlled to be 25 wt.% for SiO_2@Fe_3C/Fe@NCNT-GT.

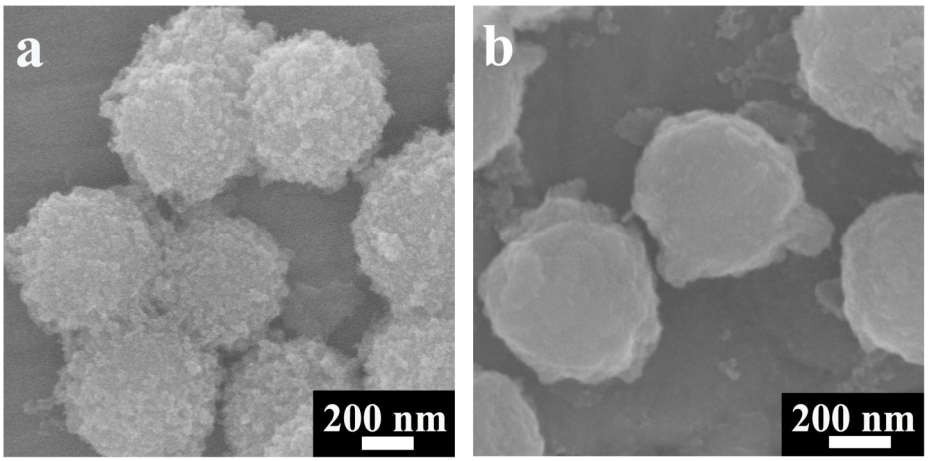

Figure S1. SEM images of SiO_2@$Fe(OH)_3$ and SiO_2@$Fe(OH)_3$-GT.

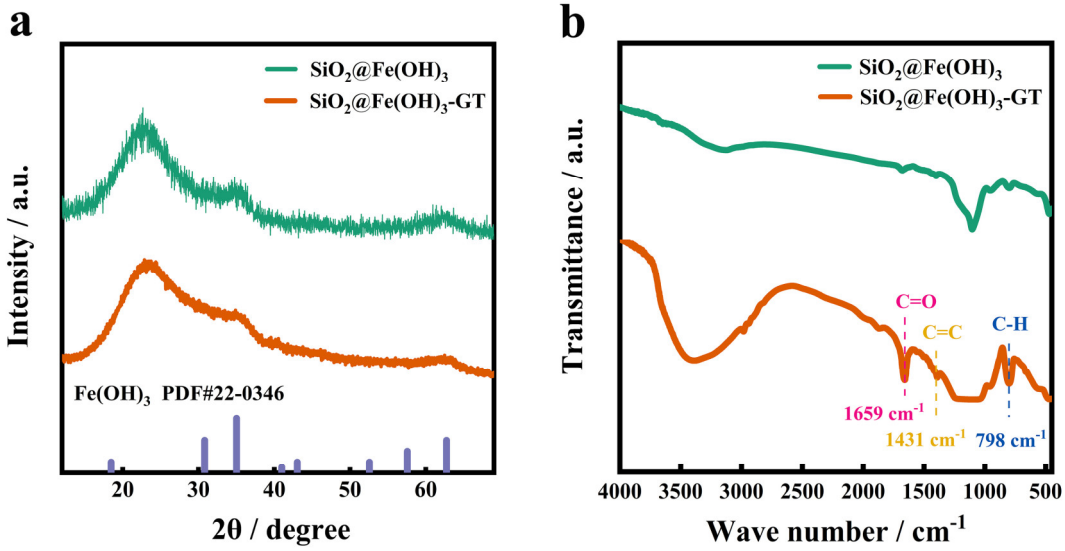

Figure S2. XRD patterns and FTIR spectras of SiO_2@$Fe(OH)_3$ and SiO_2@$Fe(OH)_3$-GT.

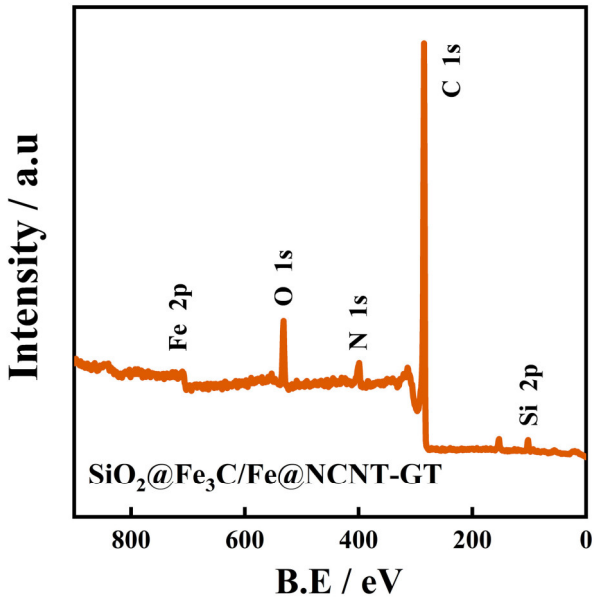

Figure S3. XPS spectra of the SiO_2@Fe_3C/Fe@NCNT-GT.

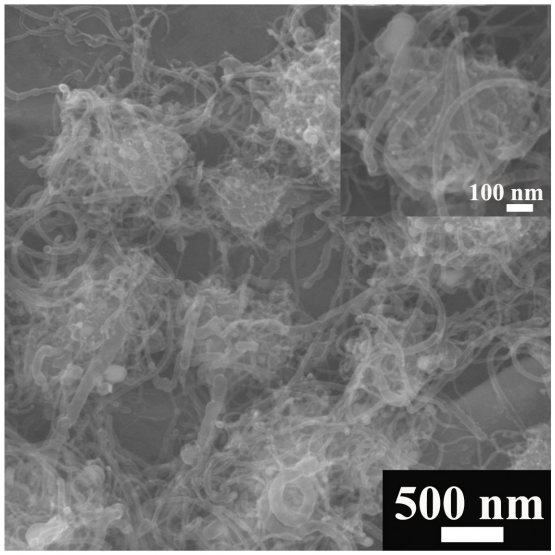

Figure S4. SEM image of SiO_2@Fe_3C/Fe@NCNT-GT.

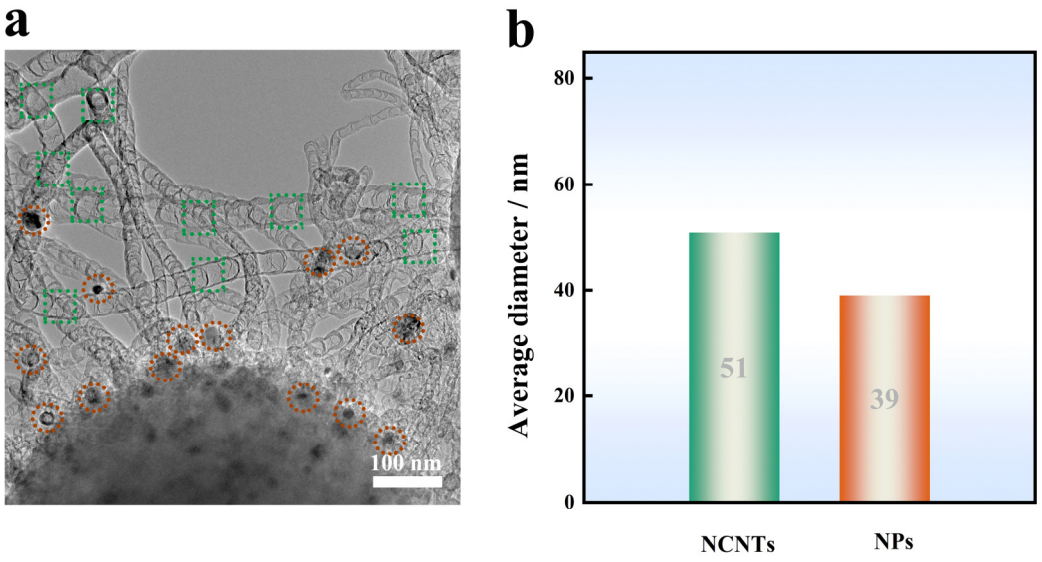

Figure S5. (a) TEM image, (**b**) Average diameter of NCNTs and NPs of SiO_2@Fe_3C/Fe@NCNT-GT.

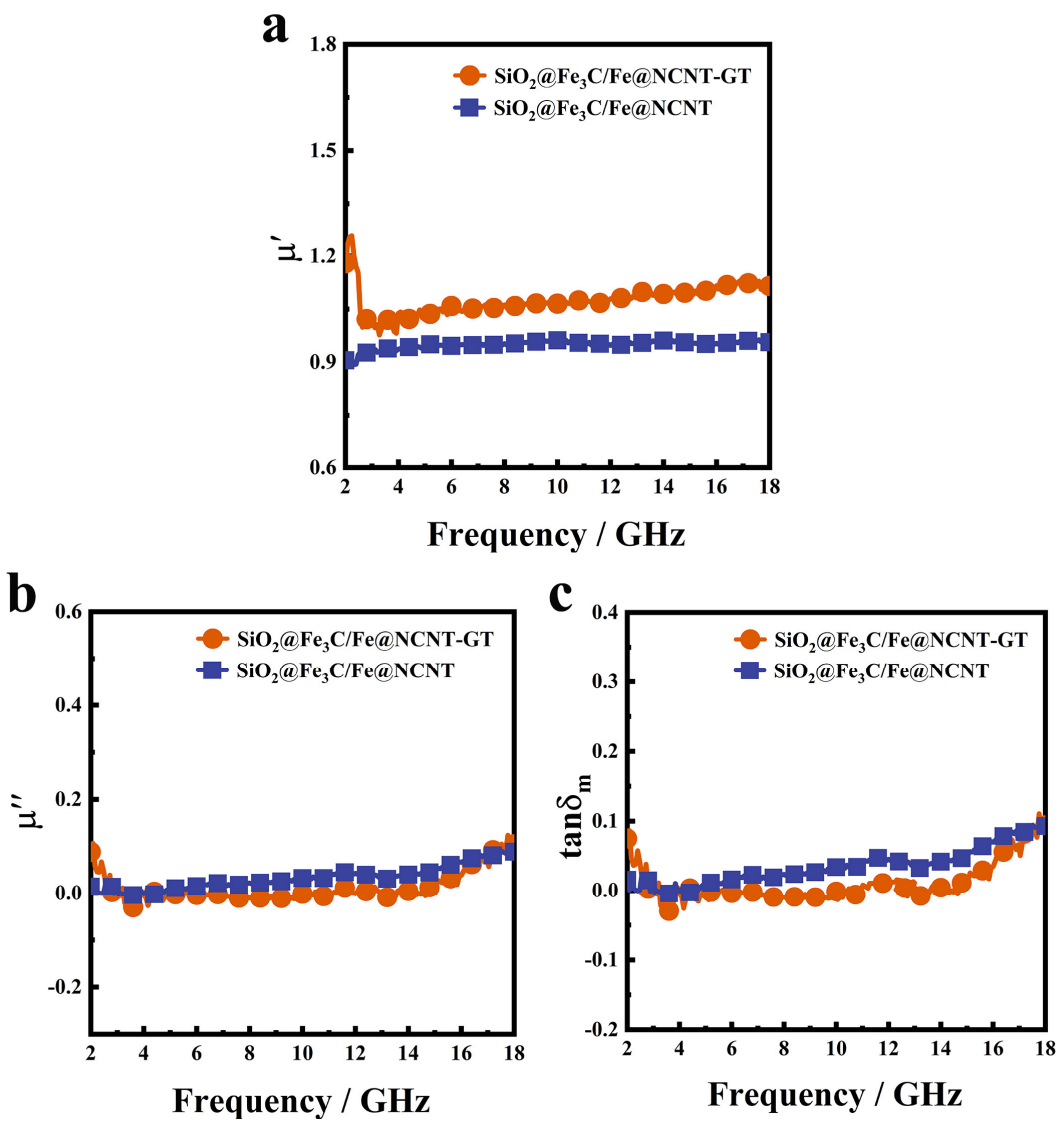

Figure S6. (**a**) $\mu'-f$ curves, (**b**) $\mu''-f$ curves, and (**c**) $\tan\delta_m-f$ of SiO_2@Fe_3C/Fe@NCNT-GT and SiO_2@Fe_3C/Fe@NCNT.

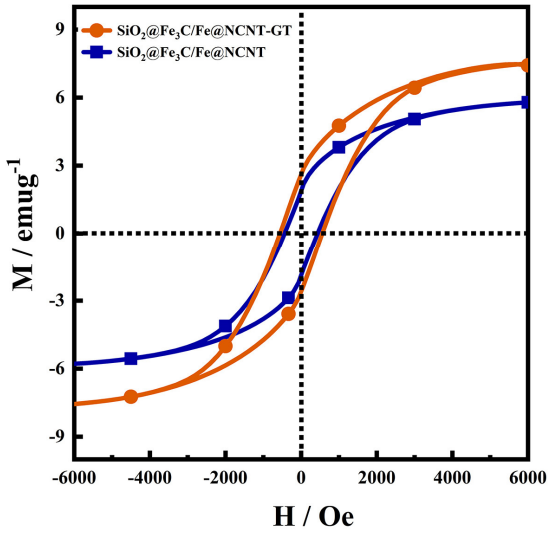

Figure S7. Magnetization hysteresis loops of the SiO_2@Fe_3C/Fe@NCNT-GT and SiO_2@Fe_3C/Fe@NCNT.

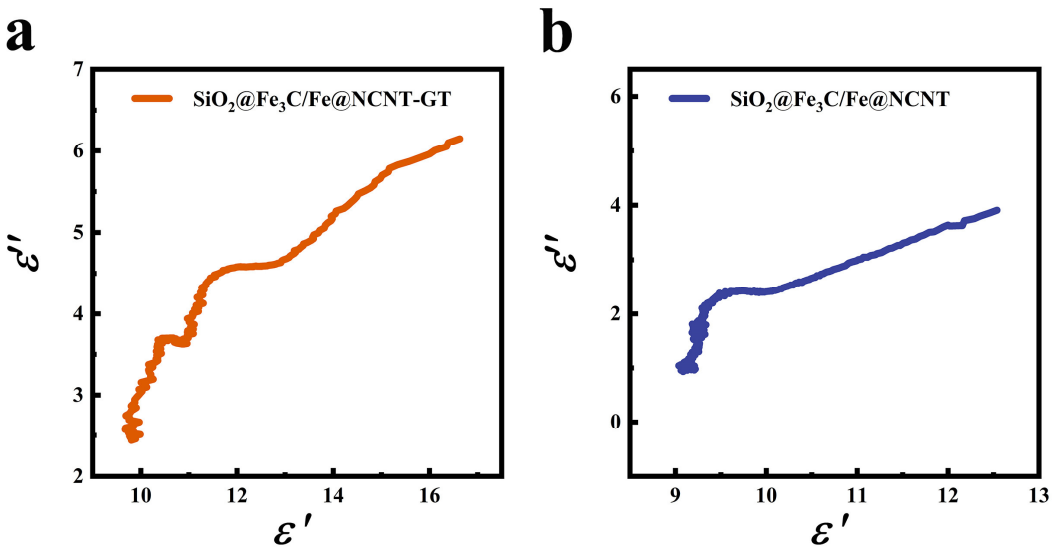

Figure S8. Cole-Cole semicircles of the (**a**) SiO_2@Fe_3C/Fe@NCNT-GT and (**b**) SiO_2@Fe_3C/Fe@NCNT.

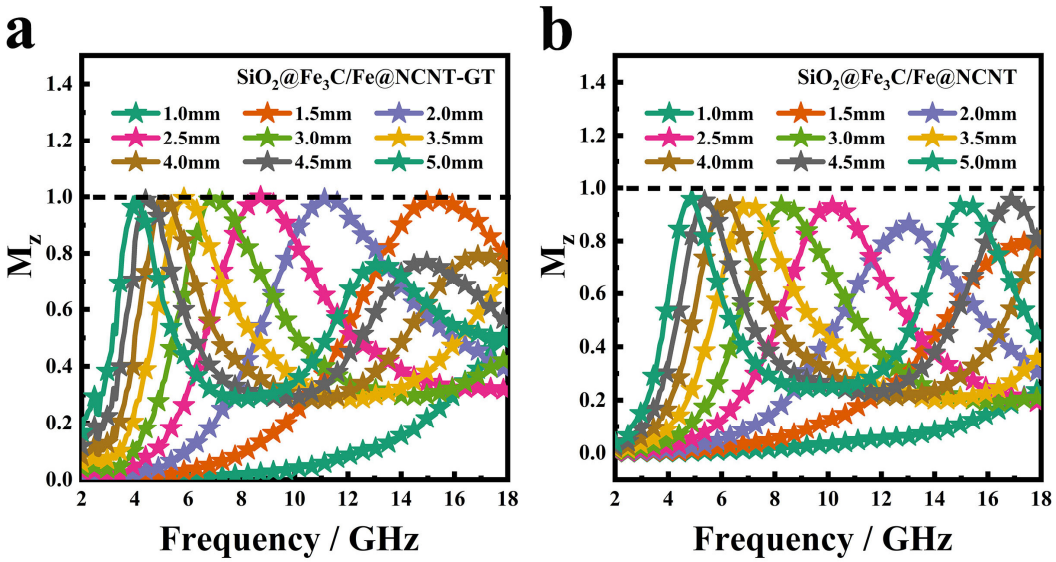

Figure S9. The M_z—f curves of the (**a**) SiO_2@Fe_3C/Fe@NCNT-GT and (**b**) SiO_2@Fe_3C/Fe@NCNT.

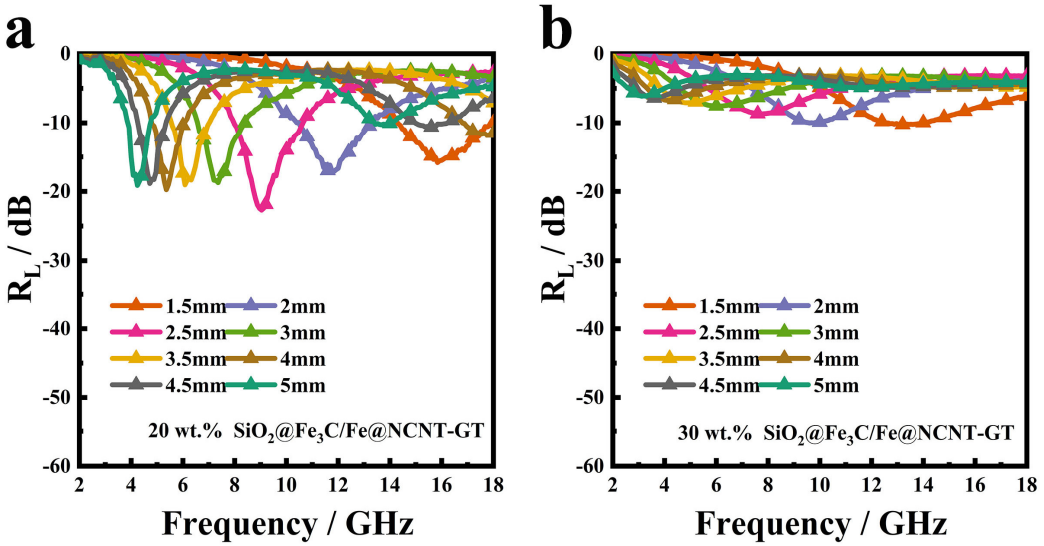

Figure S10. R_L—f curves of (**a**) the SiO_2@Fe_3C/Fe@NCNT-GT with a filler ratio of 20 wt.% and (**b**) 30 wt.%.

Table S1. Electrical conductivity of absorbing materials.

Sample	Electrical conductivity (S m^{-1})
SiO_2@Fe_3C/Fe@NCNT	0.435
SiO_2@Fe_3C/Fe@NCNT-GT	0.686

Table S2. EMW absorption properties of some representative materials.

Sample	f_r wt.%	d mm	EAB_{10} GHz	$R_{L,min}$ dB	SRL dB/m	SEAB GHz/m	Ref.
CoNi/NG hybrids	30	2.0	~5.5	–22.0	3.7	0.9	[2]
CNT/RGO/$BaFe_{12}O_{19}$	20	2.5	3.8	–19.0	3.8	0.7	[3]
Co NPs/porous C	25	3.0	4.93	–30.3	4.0	0.6	[4]
Ni/C	50	2	4.3	–32.0	3.2	0.4	[5]
Fe_3O_4/C core−shell nanospindles	60	2.1	~3.0	–38.8	3.1	0.2	[6]
CNT@TiO_2	30	2.0	3.1	–31.8	5.3	0.5	[7]
MWCNTs/Ni	60	~5.2	-	–37.0	1.2	-	[8]
MWCNTs/Fe	60	~4.3	-	–39.0	1.5	-	[8]
MWCNTs/Co	60	~5.3	-	–37.0	1.2	-	[8]
Fe_3O_4/polypyrrole/CNT	20	3.0	4.5	–25.9	4.3	0.7	[9]
GO/CNT–Fe_3O_4	30	5.0	~1.5	–37.2	2.5	0.1	[10]
raw CNT's	45	3.0	0	–9.9	0.7	0	[10]
purified CNT's	45	3.0	2.9	–14.9	1.1	0.2	[11]
Fe/CNT's	20	3.5	4.2	–22.7	3.2	0.6	[12]
Fe_3O_4/BN CNT's	-	2.0	8.1	–42.2	-	-	[13]
Fe_3O_4/BN CNT's	-	2.5	13.1	–47.9	-	-	[13]
Ni/MWNT	5	4.0	4.4	–23.1	11.5	2.2	[14]
Ni/MWNT	10	4.0	3.4	–17.8	4.4	0.8	[14]
Fe/Fe_3C/MWCNT	50	2.0	2.4	–12.5	1.2	0.2	[15]
Fe:Fe_3C/MWCNT	50	3.5	2.3	–14.1	0.8	0.1	[15]
Er_2O_3/MWCNT	20	2.0	2.3	–27.7	6.9	0.6	[16]
Sm_2O_3/MWCNT	20	2.0	1.6	–21.5	5.4	0.4	[17]
PPy (30 wt%)	30	2.6	6.8	–56.3	7.2	0.9	[18]
PANI	17.5	2.1	5.5	–25.2	6.8	1.4	[19]
SiO_2@Fe_3C/Fe@NCNT-GT	25	1.5	4.51	–48.43	12.9	1.2	This work

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