Supplementary Information for

Ultrathin and Flexible Hybrid Film Decorated by Copper Nanoparticles with Sandwich-like Structure for Electromagnetic Interference Shielding

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Highlights of the paper

- CNT/Cu hybrid films are prepared via one-step electrodeposition method.
- The CNT/Cu hybrid films show a sandwich-like morphology.
- The resistance of CNT/Cu hybrid film is very close to that of pure copper foil.
- The CNT/Cu hybrid films show absolute shielding effectiveness of 32550 dB cm^2 g^{-1}

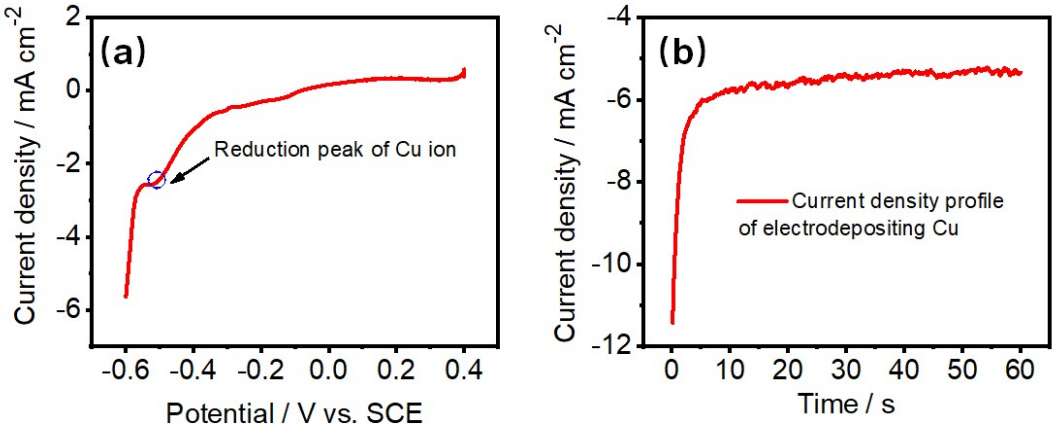

Figure S1. a) The Linear sweep voltammetry curves of Cu on CNT film from 0.4 V to -0.6 V vs. SCE. b) The current density profile of electroplating Cu.

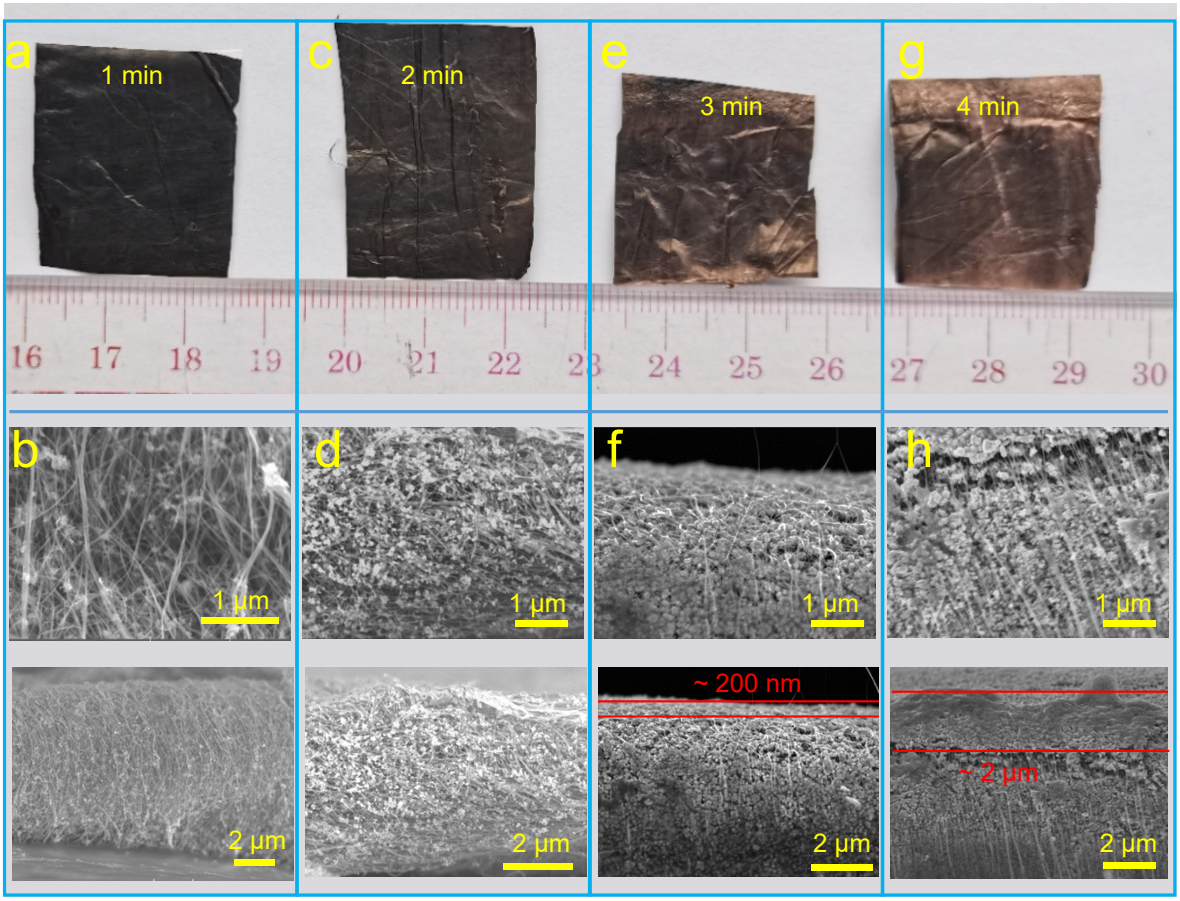

Figure S2. The photographs of CNT/Cu hybrid film after (a) 1min, (c) 2 min, (e) 3 min and (g) 4 min electrodeposition. The breaking morphology of (b) CNT/Cu1, (d) CNT/Cu2, (f) CNT/Cu3, (h) CNT/Cu4.

Supplementary Table 1. Summary of electrical conductivity and surface density for CNT foils, CNT/Cu foils, and Cu paper.

Sample	Conductivity ($S\ cm^{-1}$)	Surface density ($g\ cm^{-2}$)	Load of Cu ($mg\ cm^{-2}$)
CNT paper	27.9	0.0011	0
CNT/Cu_1	54.1	0.0012	0.1
CNT/Cu_2	61.3	0.0013	0.2
CNT/Cu_3	76.8	0.0015	0.4
CNT/Cu_4	104.2	0.002	0.9
copper foil	105.4	3.787	full

Supplementary Table 2. Summary of the absolute effectiveness (SSE/t) in X-band versus thickness of different EMI shielding materials

	Filler [wt.%]	Matrix	T [mm]	Conductivity [S m^{-1}]	EMI SE [dB]	SSE/t [dB cm^2 g^{-1}]	References
SWCNT	7	PS	1.2	0.001	18.5	275	1
MWCNT	20	PC	2.1	3	39	164	2
MWCNT	20	PS	2	0.1	30	285	3
MWCNT	15	ABS	1.1	1.235	50	437.2	4
MWCNT	0.5	Carbon foam	2.75	150	85	594	5
Graphene	10	PEI	2.3	1.75×10^{-8}	12.8	191.3	6
Graphene	30	PS	2	\	29	257.6	7
Graphene	16	PI	0.8	0.8	21	11712	8
Graphene	7	PS	2.5	43.5	45.1	692	9
Graphene	25	PEDOT	0.8	\	70	841	10
Graphene	Bulk	\	0.05	1136	62	15309	11
MXene	44	CNF	0.035	143	39.6	7029	12
Mxene	20	PVA	0.027	No	44.4	9343	13
MXene	2.5	PVA	0.3	8.0×10^{-4}	21	3867	14
Mxene	40	ANF	0.014	\	24.5	8814.5	15
Mxene	90	CA	0.026	1.3	54.3	17586	16
Mxene	90	SA	0.008	2963	57	30830	17
CuNi	Bulk	\	1.5	\	25	690	18
Graphene/Cu	Bulk	\	10	20.83	52.49	3170	19
Ag nanowire	0.53 (vol%)	Cellulose	0.1642		48.6	5585	20
Ag	0.51 vol%	Silicone	0.7	279.3	30.5	618.6	21

Fe_3O_4@MWCNTs	7	PMMA	2.5		13.1	200	22
Stainless-steel fiber	1.1 vol%	PP	3.1	0.001	48	241.94	23
Fe3O4@graphene	10	PEI	2.5	\	17.8	166	24
MWCNT-Fe_3O_4	2-7	PFC2Fs	2	0.02	62	2468	25
Pd-CNT-Cu	15	Cu	0.2	\	35	108	26
MWCNT	□	Cu	0.005	□	□	32550	This work

Supplementary Reference

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