Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting information

Asymmetric Conductive Polymer Composite Foam for Absorption Dominated Ultra-Efficient Electromagnetic Interference Shielding with Extremely Low Reflection Characteristics

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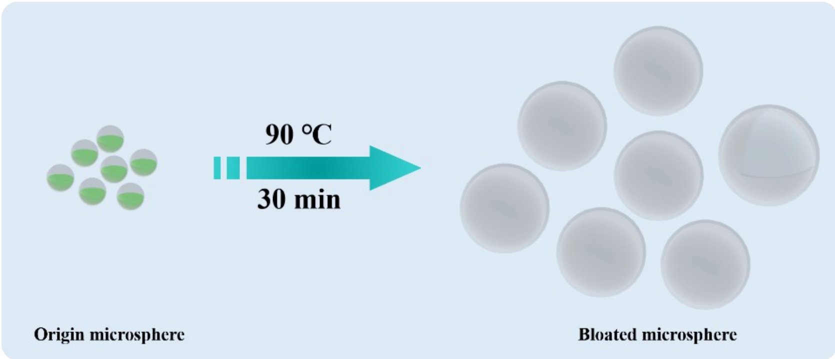

Figure S1 Schematic illustration of expansion process of expandable polymer beads.

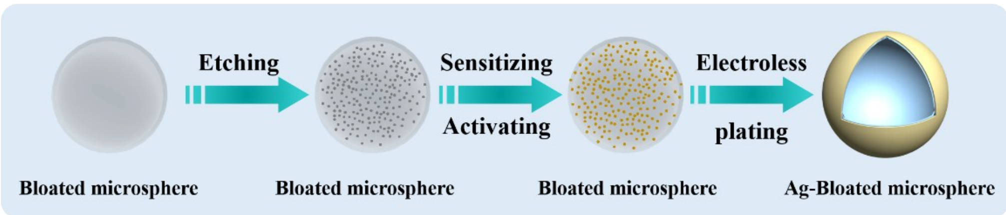

Figure S2 Schematic illustration of the preparation of Ag-Bloated microsphere complex particles.

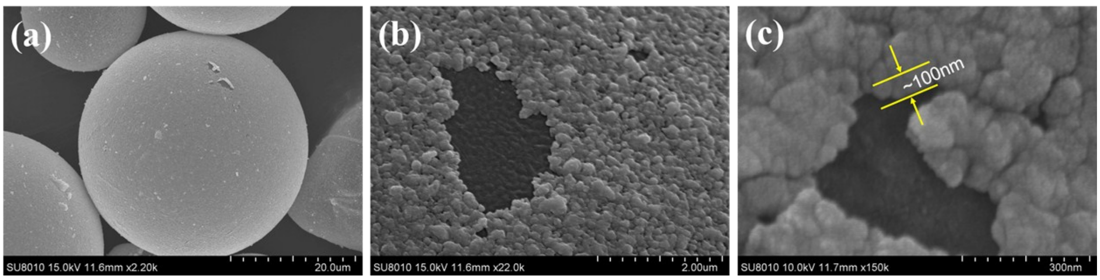

Figure S3 SEM images of EBAgs.

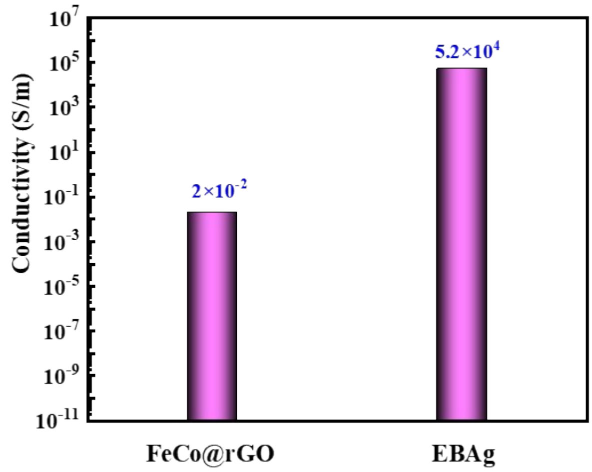

Figure S4 The conductivity of the FeCo@rGO and EBAg composite particles

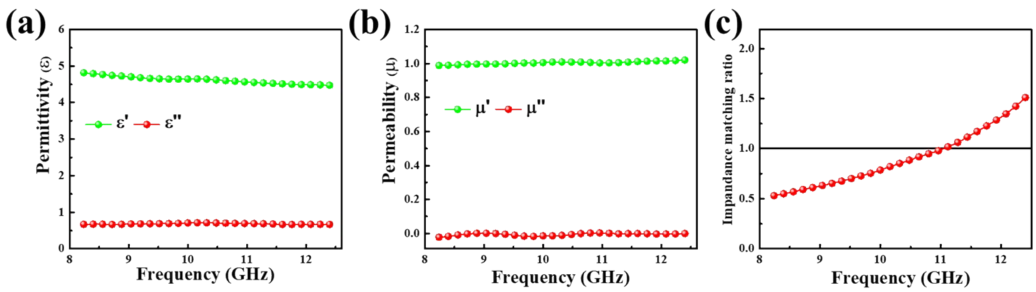

Figure S5 (a) and (b) are frequency dependence of permittivity and permeability of FeCo@rGO; (c) frequency dependence of the normalized input impedance of FeCo@rGO nanoparticles.

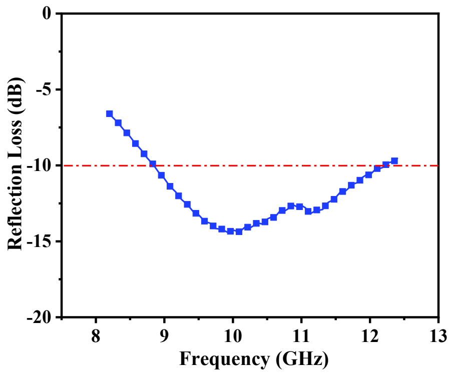

Figure S6 Reflection loss of the composite foam with 0.15 vol% Ag and 0.33 vol% FeCo@rGO in the X band.

Table S1 Electromagnetic parameters of EBAg/FeCo@rGO/WPU composite foams

Samples	A	R	T
0.05 vol% Ag-0.22 vol% FeCo@rGO/WPU	0.39	0.52	0.09
0.10 vol% Ag-0.22 vol% FeCo@rGO/WPU	0.51	0.49	6.7×10^{-6}
0.15 vol% Ag-0.22 vol% FeCo@rGO/WPU	0.72	0.28	7.5×10^{-9}
0.15 vol% Ag-0.33 vol% FeCo@rGO/WPU	0.92	0.08	3.5×10^{-9}
0.15 vol% Ag-0.43 vol% FeCo@rGO/WPU	0.87	0.13	4.5×10^{-7}

Table S2 Comparison of EMI SE between the WPU composite foam and recently reported shielding materials

	Sample	EMI SE (dB)	Thickness (mm)	Specific EMI SE (dB/mm)	SE_R (dB)	R	Ref
Shielding materials with high EMI SE	PS/MXene	61.2	2.0	30.6	6.5	0.78	S1
	EP/AgPs/rGF	58.0	3.0	19.3	6	0.75	S2
	PVDF/ MWCNTs/graphene	62.7	6.0	10.5	7	0.8	S3
	WPU/CNT	49	4.5	10.9	9	0.87	S4
	PS/Cu	60.0	4.0	15.0	10	0.9	S5
	Cellulose/AgNW	48.6	0.5	97.2	14	0.96	S6
	PG/PI	54	0.04	1350	19	0.99	S7
	liquid-metal/PDMS	81.6	1	81.6	15	0.97	S8
	EP/Mxene	41	2	20.5	6	0.75	S9
	PU-AgNWs/textile	63.9	0.6	106.5	5.4	0.71	S10
	PEI/CNT	37.9	2	19.0	5.6	0.72	S11
	PP/PDA/AgNPs/PDMS	71.2	0.4	178	14	0.96	S12
	CNT/rGO@Fe_3O_4/PC	43.5	2.0	21.8	5.0	0.68	S13
	Ag/Fe_3O_4@MWCNTs/Silicone rubber	59.4	2.0	29.7	4.7	0.66	S14
	Ni-Co-Fe-P/PANI/PI	69.4	0.2	347	5.6	0.72	S15
Shielding materials with absorption-dominated feature	SWCNTs/rGO/ PDMS	31.9	2.0	16.0	1.1	0.22	S16
	GNP/Fe_3O_4/epoxy	17	2	8.5	2.5	0.44	S17
	Fe_3O_4@rGO/ natural rubber	42.4	1.8	23.5	2.5	0.44	S18
	PVDF/Ni-chains foam	26.8	2.0	13.4	2.5	0.44	S19
	PEDOT:PSS/Fe_3O_4-rGO/Carbon/polyurethane	54	5.0	10.8	2.4	0.42	S20
	TPU/CNT	35.0	2.0	17.5	3	0.5	S21
	Ti_2CT_x/PVA	28.0	5.0	5.6	2.0	0.37	S22
	This work	**84.8**	**4.0**	**21.2**	**0.3**	**0.08**	**This work**

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Movie 1 Cyclic compression test of the WPU composite foam.