Supporting Information

Asymmetric and Flexible Ag-MXene/ANFs Composite Papers for Electromagnetic Shielding and Thermal Management

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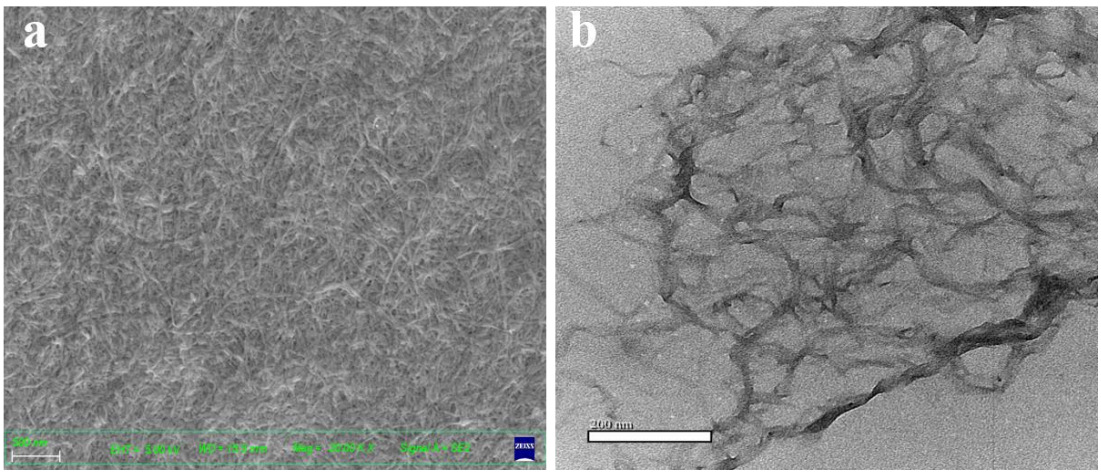

Figure S1. a SEM images of ANFs film. **b** TEM images of ANFs

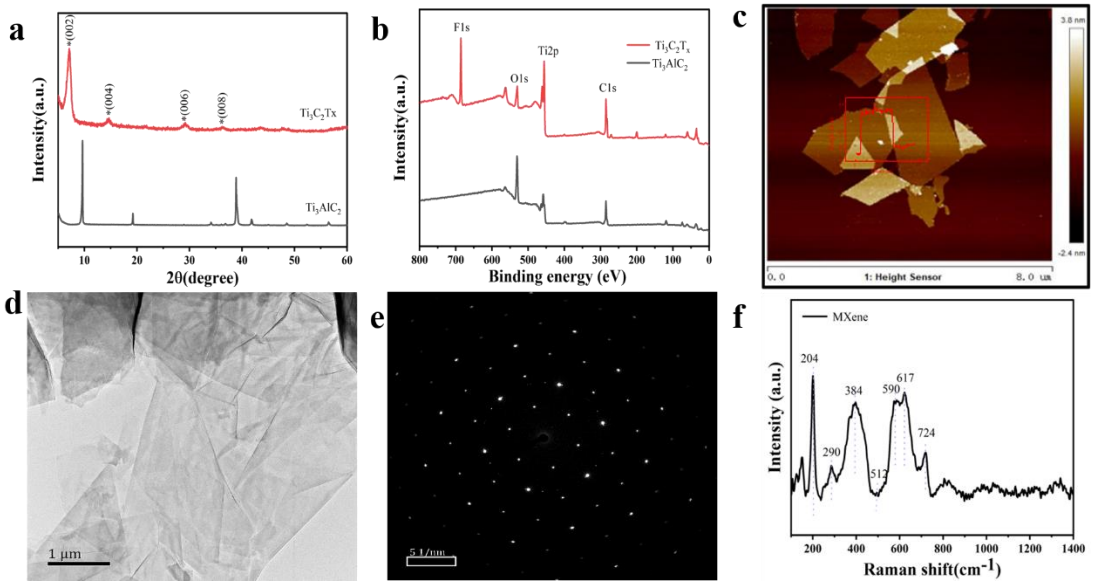

Figure S2. a XRD patterns of $Ti_3C_2T_x$ MXene. **b** XPS wide-scan spectra of $Ti_3C_2T_x$ MXene. **c** AFM images of $Ti_3C_2T_x$ MXene. **d** TFM image of $Ti_3C_2T_x$ nanosheets. **e** SAED image of $Ti_3C_2T_x$ nanosheets. **f** Raman spectra of $Ti_3C_2T_x$ nanosheet.

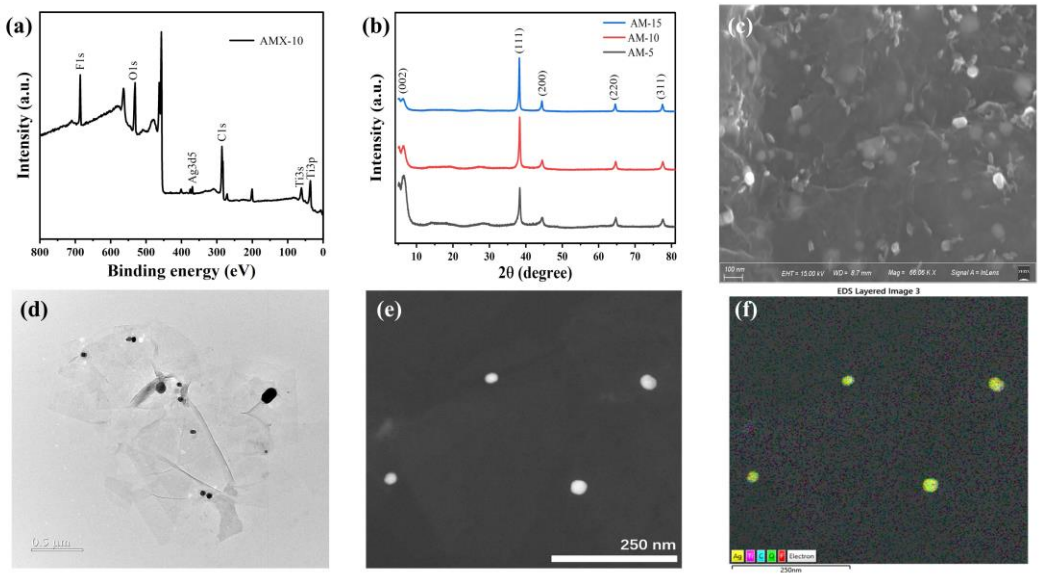

Figure S3. a Survey XPS spectra for Ag-MXene hybrids. **b** The XRD patterns of Ag-MXene hybrid nanocomposites. **c** SEM images of Ag-MXene hybrid nanocomposites. **d** TEM images of formed Ag-MXene hybrid nanocomposites. **e-f** EDS spectra of Ag-MXene Hybrids.

Figure S4. a-c Digital images of the as-obtained AMAGM composite paper.

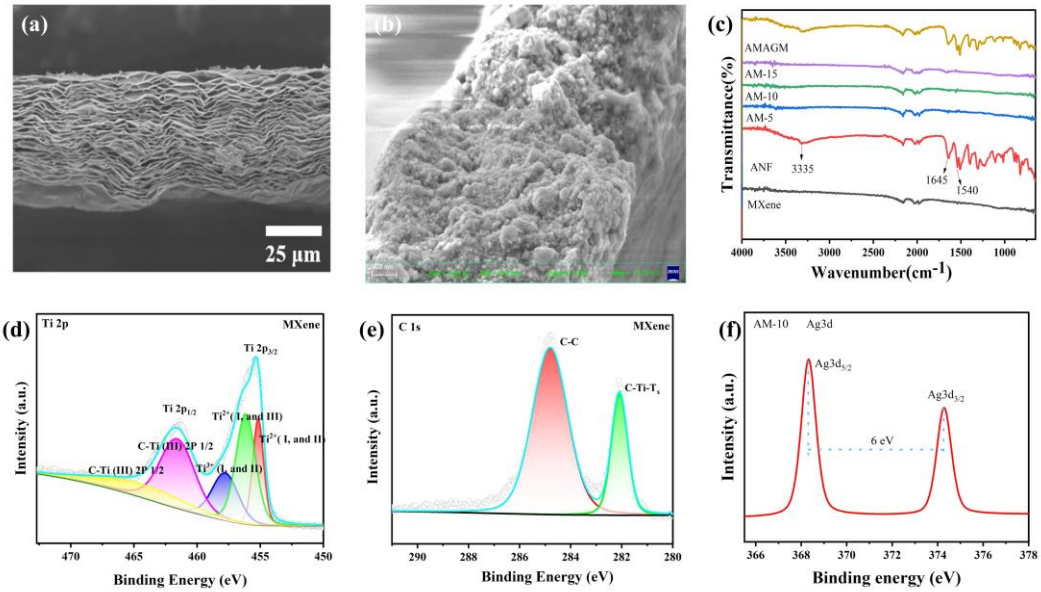

Figure S5. Morphology and structure characterization. **a** Cross-sectional SEM images of $Ti_3C_2T_x$ nanosheets paper. **b** Cross-sectional SEM images of Ag-MXene composite paper. **c** FTIR spectra of MXene, ANFs and AMAGM nanocomposite papers. XPS surveys of delaminated $Ti_3C_2T_x$ nanosheets and Ag-MXene nanocomposites. **d** High-resolution spectra of C 1s for MXene. **e** High-resolution spectra of Ti 2p for MXene. **f** High-resolution XPS spectra of Ag 3d for Ag-MXene hybrids.

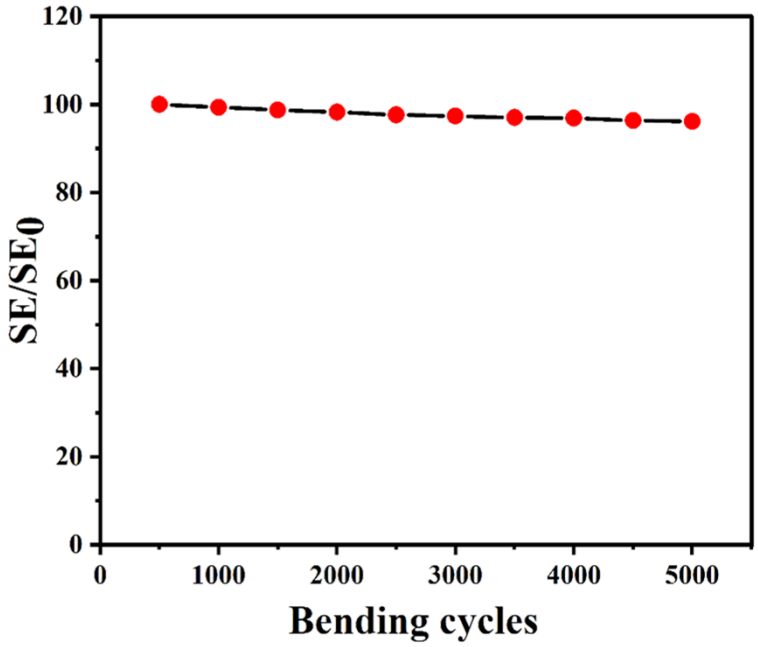

Figure S6. EMI SE variation of the AMAGM composite paper after 5000 cycles of bending deformation.

Table S1. Performance comparison of AMAGM nanocomposite papers with previous reported EMI shielding materials.

Type	Sample	Materials	Thickness (mm)	SE (dB)	SSE/t (dB cm^2g^{-1})	Refs.
Metal-based	1	Ag NW	0.5	35	12416	[1]
	2	Cu foil	0.01	70	7812	[2]
	3	Ni fiber/PES	2.85	58	109	[3]
	4	Ni filaments/PES	2.85	87	165	[4]
	5	Cu-Ni-CNT	1.5	54.6	1580	[5]
	6	Cu-Ni foam	1.5	25	690	[6]
	7	Copper	1.5	90	3200	[7]
	8	Ag NWs/WPU foam	2.3	80	10907	[8]
	9	Ag NW/epoxy	0.4	25.09	5018	[9]
	10	Cu NW@ graphene aerogels	3.46	52.5	3921.8	[10]
rGO-based	11	rGO	2.5	45.1	692	[11]
	12	rGO/PS	2	29	258	[12]
	13	rGO/Fe_3O_4	0.3	24	1033	[13]
	14	rGO/PEDOT	0.8	70	841	[14]
Graphe	15	Graphene	2	75	4165	[15]

ne-based		foam/CNT/PDMS				
	16	Graphene/PDMS foam	1	30	5000	[16]
	17	Graphene/PDMS	0.1	20	3330	[17]
	18	Microcellular graphene foam	0.3	25.2	14000	[18]
CNT-based	19	MWCNT/WPU	0.1	21.1	5410	[19]
	20	MWCNT/PC	2.1	39	164	[20]
	21	MWCNT/ABS	1.1	50	433	[21]
	22	MWCNT/PS	2	30	285	[22]
	23	SWCNT/PS	1.2	18.5	275	[23]
	24	SWCNT/epoxy	2	25	720	[24]
	25	MXCNT	3	104	8253	[25]
	26	CNT sponge	2.38	22	4522	[26]
	27	MWCNT/PLA foam	2.5	23	3080	[27]
	28	MWCNT/WPU	0.32	50	3408	[28]
	29	Fe_3O_4@rGO/MWCNT/WPU	2.3	23	4991	[29]

Carbon-based	30	Carbon foam	0.2	40	1250	[30]
	31	Carbon/PN resin	0.2	51.2	1705	[31]
	32	CB/ABS	1.1	20	1905	[32]
	33	CB/EPDM	2	18	1500	[33]
	34	Commercial carbon foam	2	40	1250	[34]
MXene-based	35	$Ti_3C_2T_x$/CNFs	0.047	24	2647	[35]
	36	$Ti_3C_2T_x$/rGO/epoxy	2	56.4	9400	[36]
	37	CNF@MXene	0.035	39.67029	6800	[37]
Conductive Polymer-based	38	PPy/ANFs	0.076	41.69	2762.5	[38]
This work	39	AMA mixture	0.0344	37.5	6319	
	40	AMAGM	0.0344	62	11923	

Supplementary References

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interference shielding performance for silver nanostructure hybrid polyimide foams. RSC Advances. 2015;5(80):65283-96.

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