Electronic Supplementary Material (ESI) for Nanoscale.

Supporting information

Bifunctional Flexible Fabrics with Excellent Joule Heating and Electromagnetic Interference Shielding Performance Based on Copper Sulfide/Glass Fiber Composite

Binguo Liu[a &]，*Qi Zhang*[b &]，*Yuanhui, Huang*[a], *Dong Liu*[b]，*Wei Pan*[a c*]，*Yunchao Mu*[a]，*Xiaozhe Cheng*[a]， *Yajie Qin*[c]

a School of Materials and Chemical Engineering, Zhongyuan University of Technology, Zhengzhou 451191, China.

b School of Materials Science and Engineering, Zhengzhou University, Zhengzhou 450001, China.

c Textile and Garment Industry of Research Institute, Zhongyuan University of Technology, Zhengzhou 451191, China.

& Binguo Liu and Qi Zhang contributed equally to this work.

Corresponding Authors:

Wei Pan, Email: doctorpan0152@163.com

Yunchao Mu：Email: yunchaomu@126.com

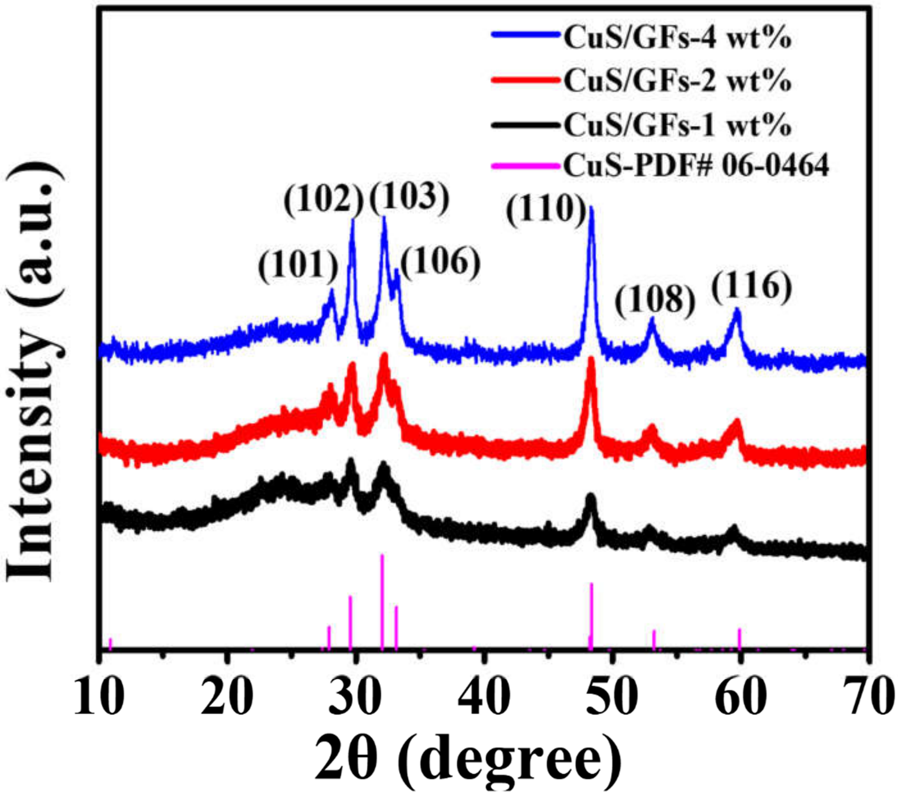

Figure S1. XRD patterns of the CuS/GFs-1 wt%, CuS/GFs-2 wt% and CuS/GFs-4 wt%, respectively.

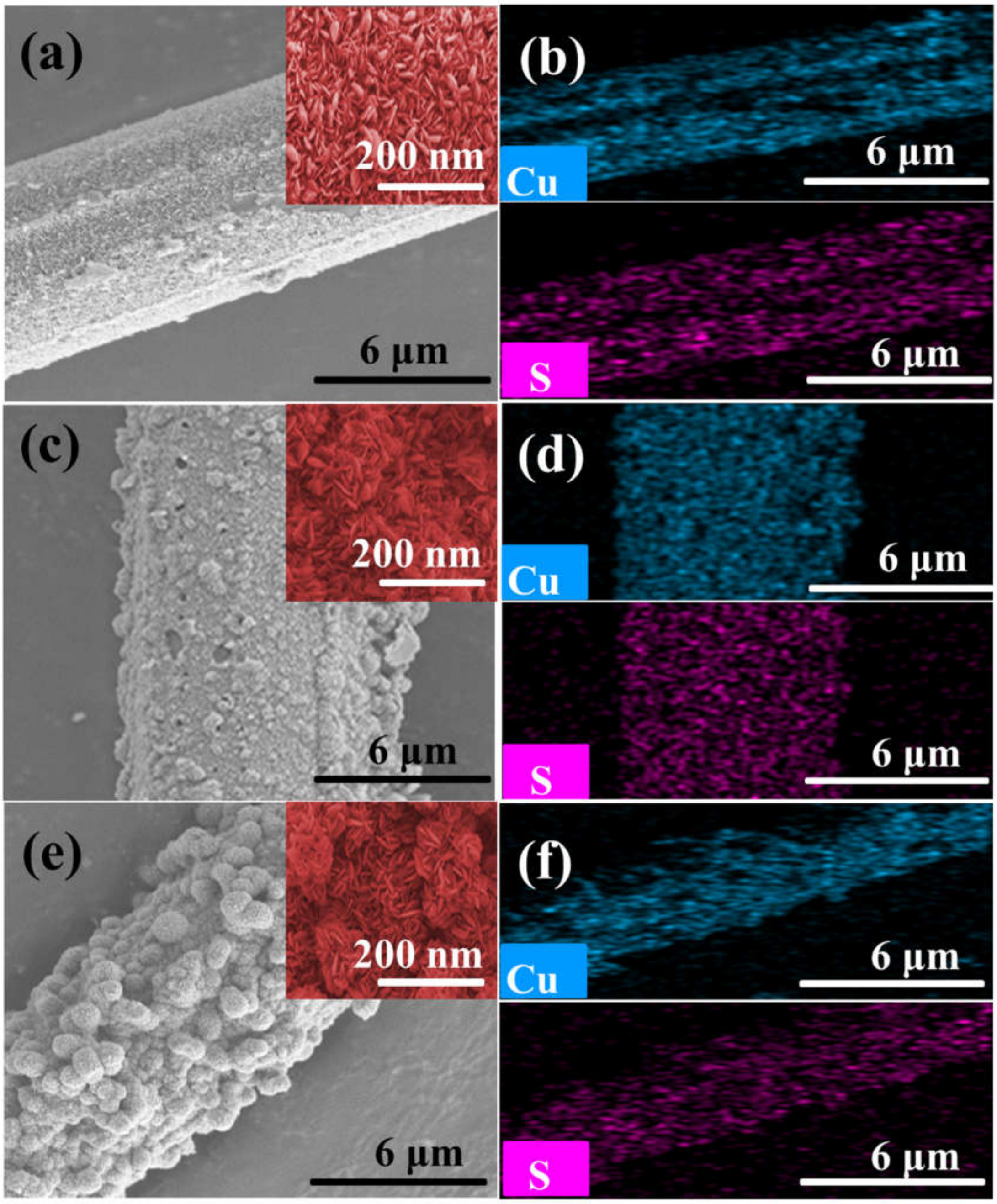

Figure S2. SEM image and elemental mappings of of the CuS/GFs-1 wt% (a and b), CuS/GFs-2 wt% (c and d) and CuS /GFs-4 wt% (e and f), respectively.

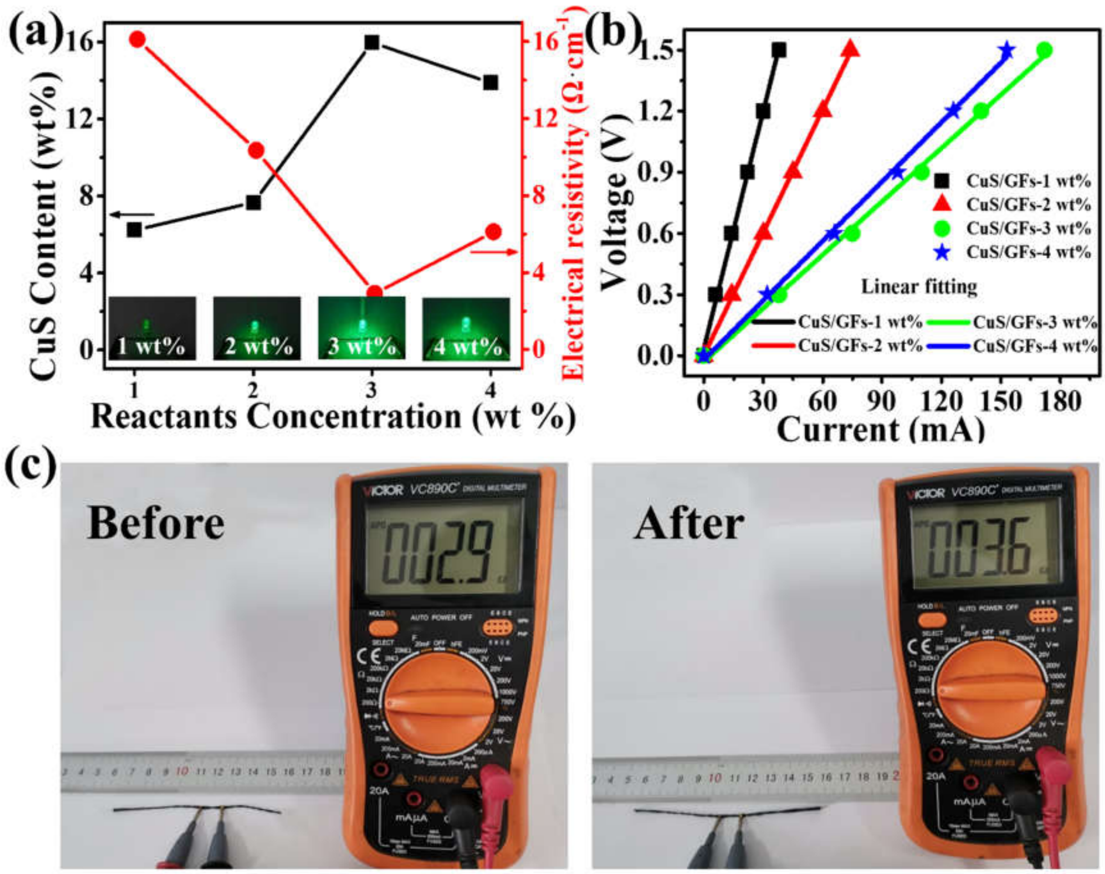

Figure S3. Mass loading for the CuS and electrical resistivity of CuS/GFs obtained at various concentrations. (b) I-V curve of as-prepared each CuS/GFs. (c) Electrical resistivity of CuS/GFs- 3 wt% before and after 0.5 h ultrasonic process.

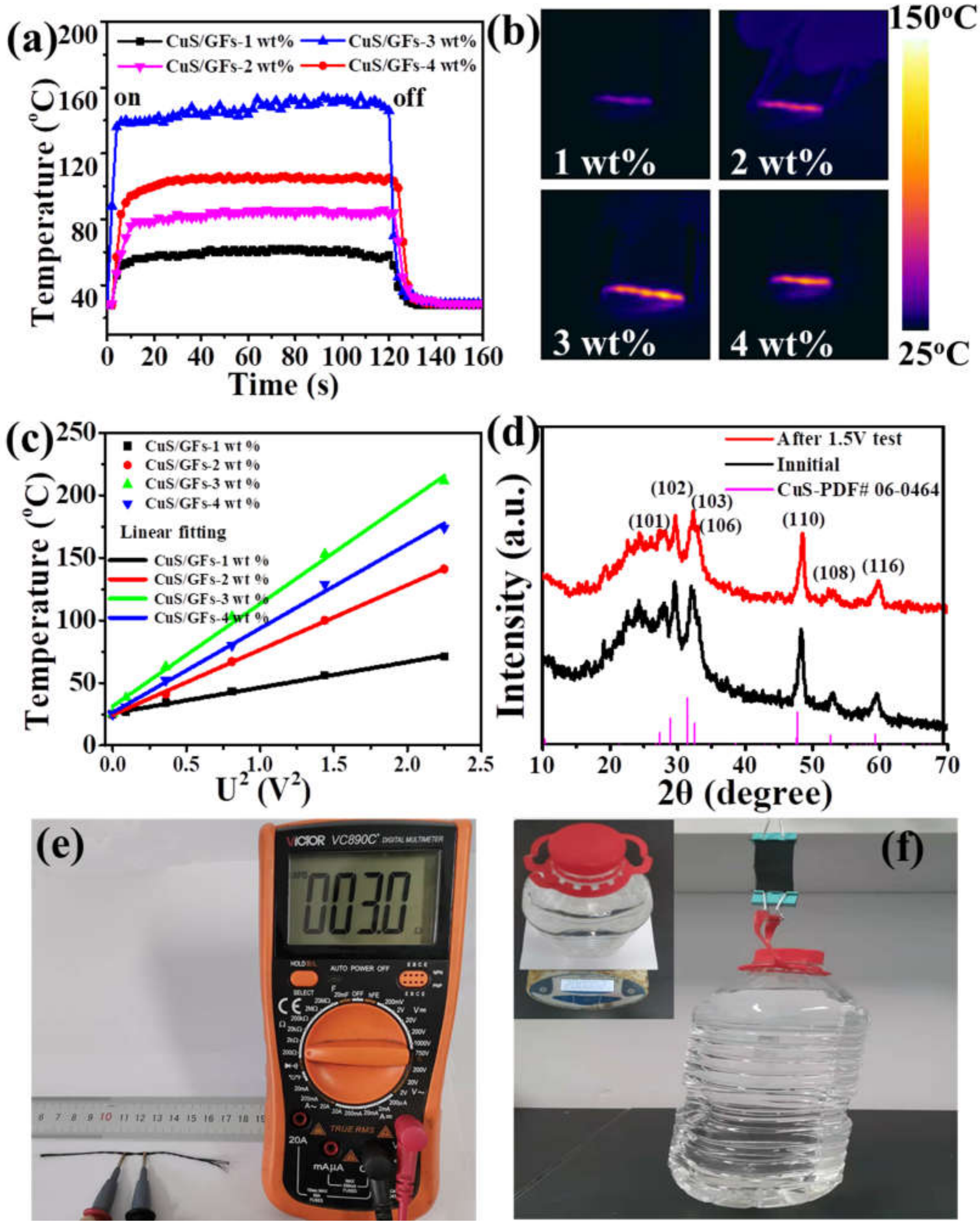

Figure. S4 (a) Joule heating performance of CuS/GFs at the constant supplied voltage of 1.2 V. (b) Corresponding IR camera images of each sample. (c) Experimental data and linear fitting of saturation temperature versus U^2 of as-prepared each nanocomposite. (d) the XRD of CuS/GFs after running under 1.5V working voltage. (e) electrical conductivity of CuS/GFs after a long-term stability test. (f) The optical photo of CuS/GFs-3 wt% textile can withstand a weight of 2000 g.

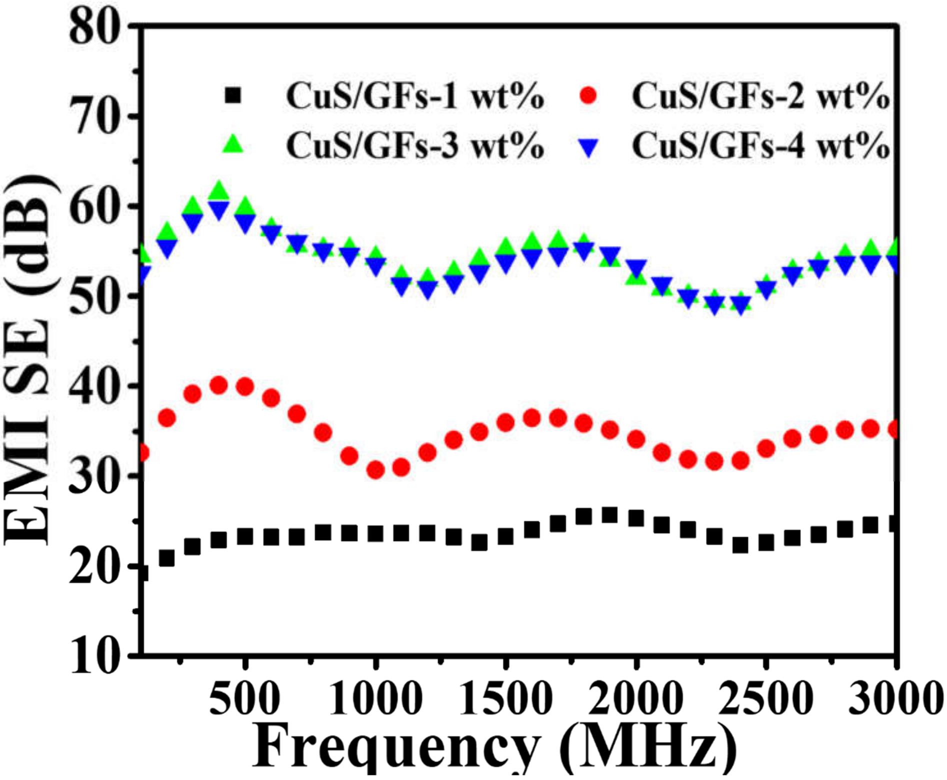

Figure S5. EMI SE performance of CuS/GFs textiles obtained at various concentrations.

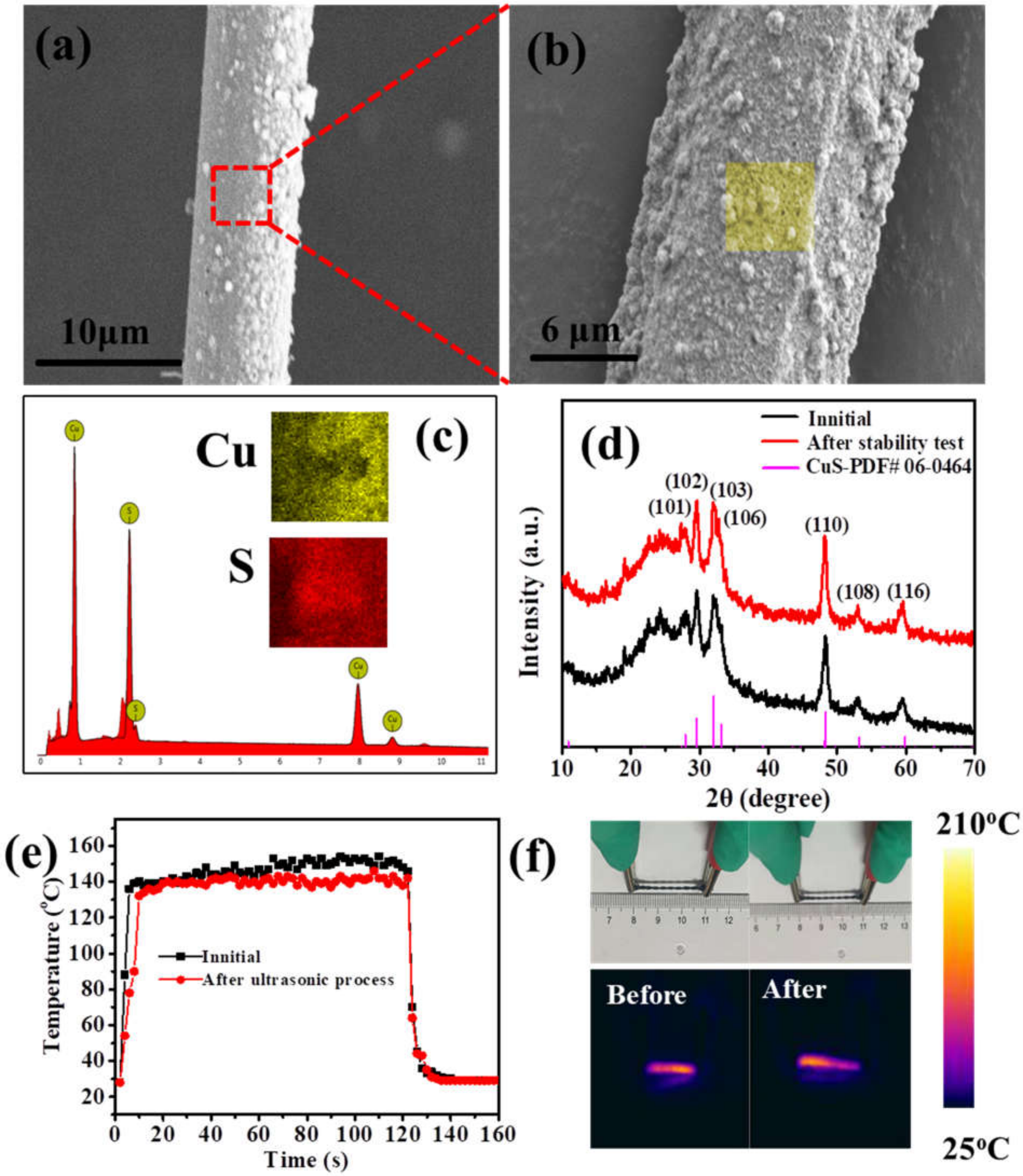

Figure S6. (a and b) SEM images, EDX spectrum and element analysis (c) of CuS/GFs-3 wt% textile after long term stability measurement. (d) XRD pattern of CuS/GFs-3 wt% textile before and after long-term stability test. (e) Joule heating performance of CuS/GFs-3 wt% at the constant supplied voltage of 1.2 V before and after 0.5 h ultrasonic process. (f) Corresponding IR camera images before-after ultrasonic process.

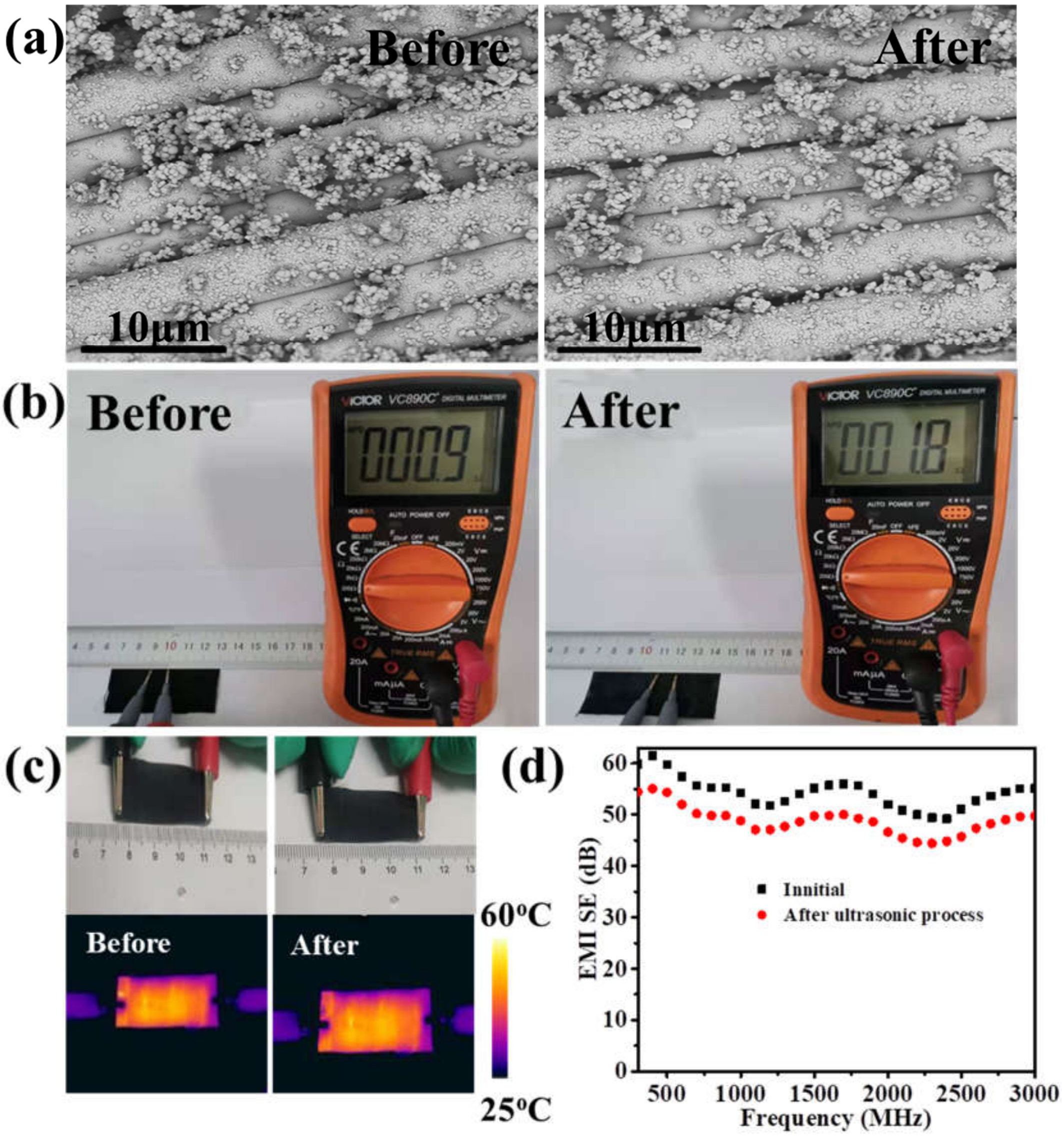

Figure S7. (a) SEM images and electrical resistivity of CuS/GFs-3 wt% textile before-after ultrasonically cleaned. (b) Electrical resistivity of CuS/GFs- 3 wt% textile before and after 0.5 h ultrasonic process. (c) and (d) IR camera images and EMI SE performance of CuS/GFs- 3 wt% textile before and after 0.5 h ultrasonic process.

Table.S1 Performance comparison between CuS/GFs and other flexible heaters

Heaters	Electrical property	Voltage (V)	Temperature (°C)	Response time (s)	Ref.
CuS/GFs	**2.9 Ω cm^{-1}**	**1.5**	**209**	**10**	**This work**
CNT/cellulose aerogel	0.3 Ω sq^{-1}	1.8	70.2	80	1
AgNWs-TPU	0.02Ω/mm	24	111.8	40	2
CNT cotton fabrics	2.5KΩ	40	96	40	3
GFs graphene films,	6×105S m^{-1}	5	424	2	4
Cu/RGO-PBO fibers	0.16Ω cm^{-1}	6	133	20	5
rGO/PET fabric	4.9 Ω·cm	6	138.64	3	6
Graphene Filters	-	3	80	240	7
graphene quartzfiber	0.2−10 kΩ/sq	24	980	10	8
G/WPU composites	700-500 S m^{-1}.	10	75.4	30	9
polypyrrole/knitted cotton fabric	55.9Ω	8	51	-	10
CNT fiber fabrics	110 S m^{-1}	3	<140	10	11
CNT/Cotton Com-posite fabric	50.75Ω sq^{-1}	8	135.3	30	12
Graphene/PU fabric	-	12	162.6	<20	13
MXene-decorated textiles	117 S m^{-1}	3.5	174	<20	14

Table S2. Performance comparison of CuS/GFs textile nanocomposite papers with previous reported EMI shielding materials

EMI shielding materials	content	t(mm)	SE (dB)	SSE/t (dB cm2 g-1)	Ref.
CuS/GFs	**16 wt%**	**1.5**	**61**	**6130.65**	**This work**
rGO/PU	4.7 vol%	60	57.7	320	15
rGO-Fe3O4/PVC	3.4 vol%	1.8	13	49.5	16
rGO/PS	3.47 vol%	2.5	45.1	167.5	17
rGO/PI	16 wt%	0.08	21	937.5	18
Graphene/PDMS	0.36 vol%	1	20	3333	19
rGO/PEI	1.38 vol%	2.3	13	188	20
rGO/WPU	5 vol%	1	34	388	21
MWCNTs/Epoxy	1.34 vol%	2	40	100.5	22
MWCNT/ WPU	7.2 vol%	4.5	50	881.8	23
CNT/PS	3.6 vol%	0.12	18.5	275	24
Ag nanowires/PI	/	0.5	35	2416	25
MXene/PVA	2.5 vol%	0.3	21	3867	26
MXene/CNF	90 wt%	0.047	24	2647	27

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