Electronic Supplementary Information

Enhanced Thermal Conductivity of Nanocomposites with MOF-derived Encapsulated Magnetic Oriented Carbon Nanotube-Grafted Graphene Polyhedra

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Content:

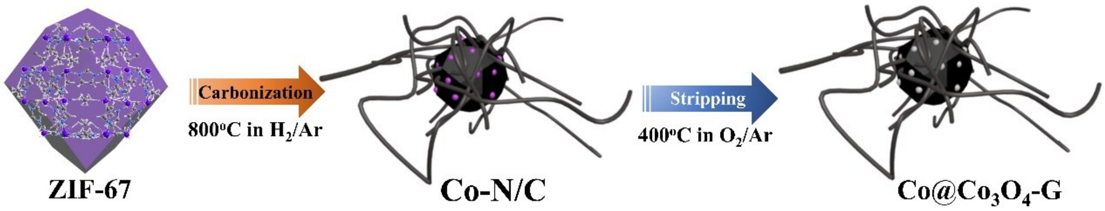


Fig. S1 Schematic illustrations of the preparation process of Co@Co_3O_4-G.

Table. S1 Physical properties of ER/Co@Co_3O_4-G nanocomposites with different Co@Co_3O_4-G volume fractions.

Vol. fraction (Vol%)	Density (g cm^{-3})	Specific heat capacity (J g^{-1} K^{-1})	Thermal diffusivity (mm^2 s^{-1})	Thermal conductivity (W m^{-1} K^{-1})
	1.05	1.38	0.13	0.19
0	1.02	1.34	0.12	0.17
	1.08	1.36	0.15	0.22
	1.23	1.31	0.19	0.32
1.2	1.19	1.33	0.22	0.35
	1.22	1.28	0.17	0.27
	1.24	1.32	0.34	0.56
2.6	1.26	1.31	0.36	0.60
	1.27	1.30	0.29	0.48
	1.28	1.29	0.80	1.32
4.3	1.29	1.28	0.83	1.37
	1.27	1.26	0.79	1.27
	1.32	1.22	1.04	1.67
6.5	1.35	1.23	1.03	1.72
	1.37	1.25	0.91	1.56
	1.38	1.21	1.26	2.11
8.7	1.37	1.18	1.39	2.24
	1.37	1.16	1.30	2.07

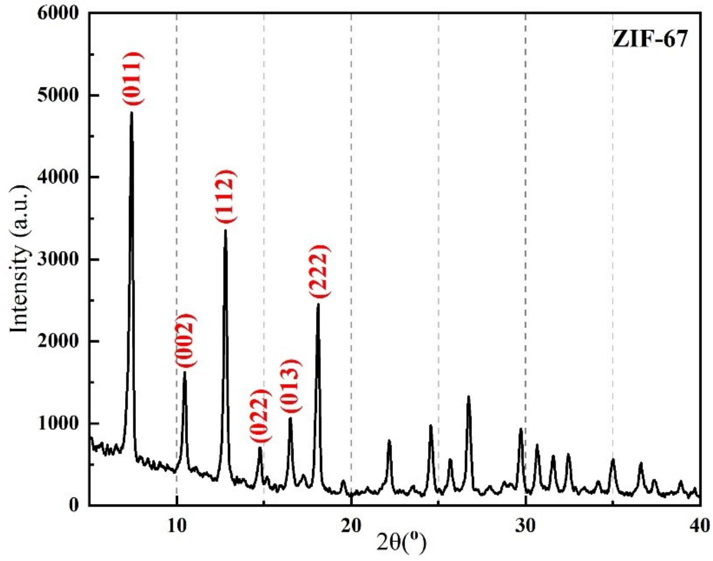


Fig. S2 The XRD of ZIF-67.

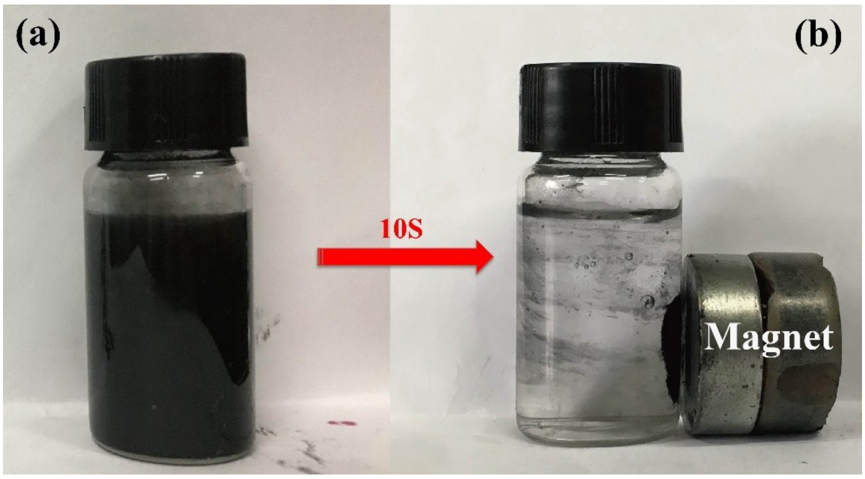


Fig. S3 Images of $Co@Co_3O_4$-G dispersion in a water solution (a) and its response to external magnetic field when a magnet is placed near the dispersion (b).

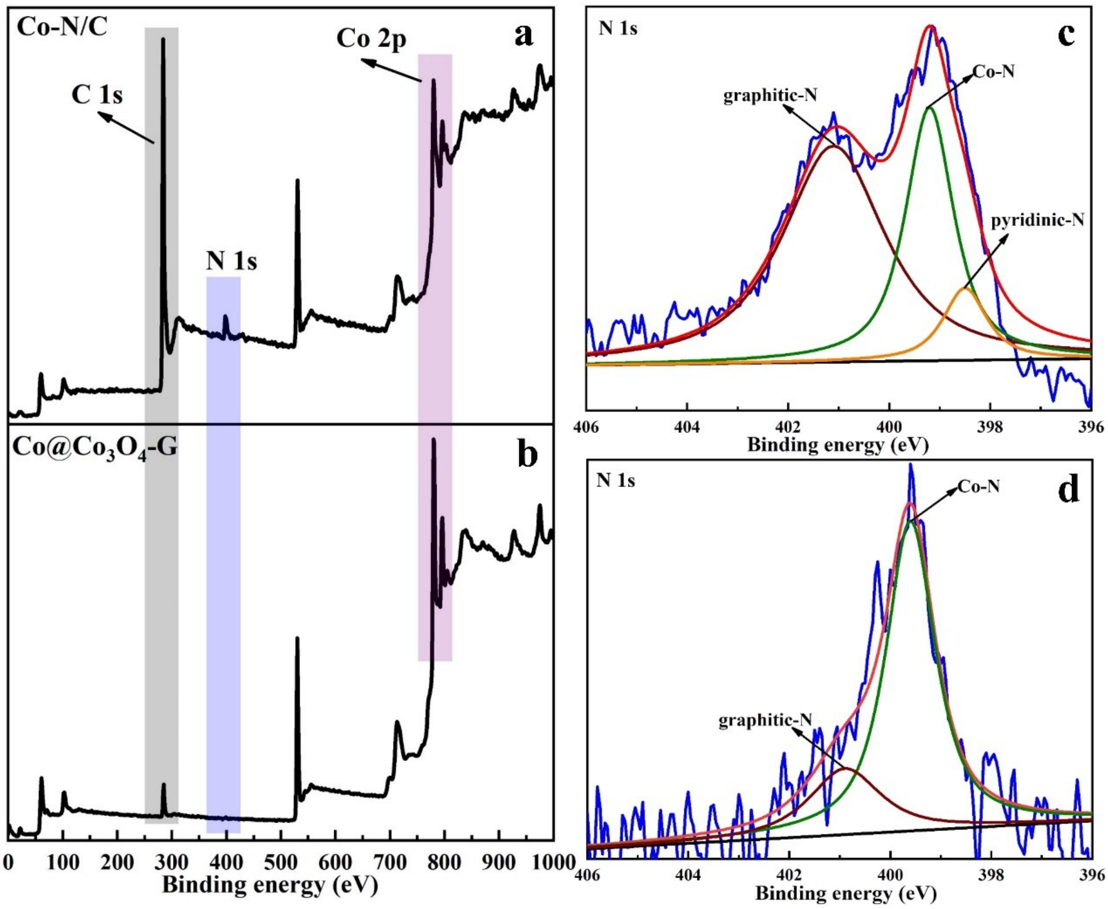


Fig. S4 Full survey XPS of Co-N/C (a) and Co@Co_3O_4-G(b), N 1s of Co-N/C (c) and Co@Co_3O_4-G(d).

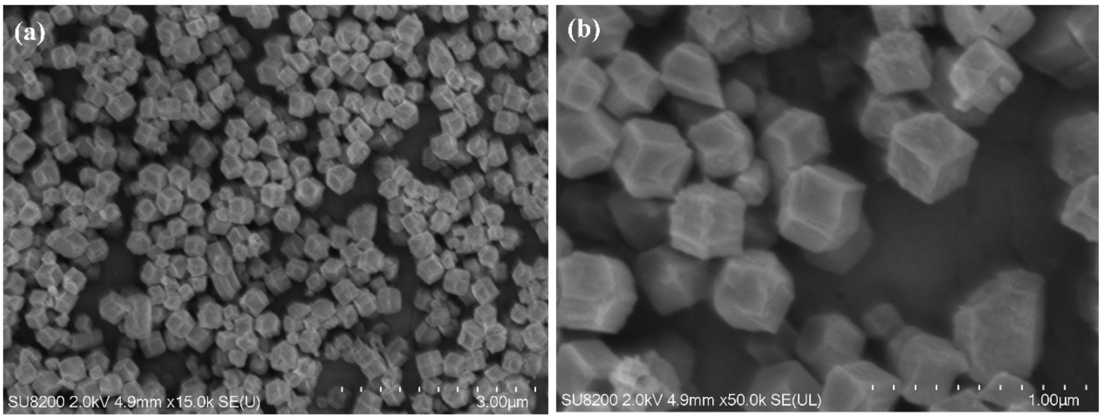


Fig. S5 SEM image of ZIF-67.

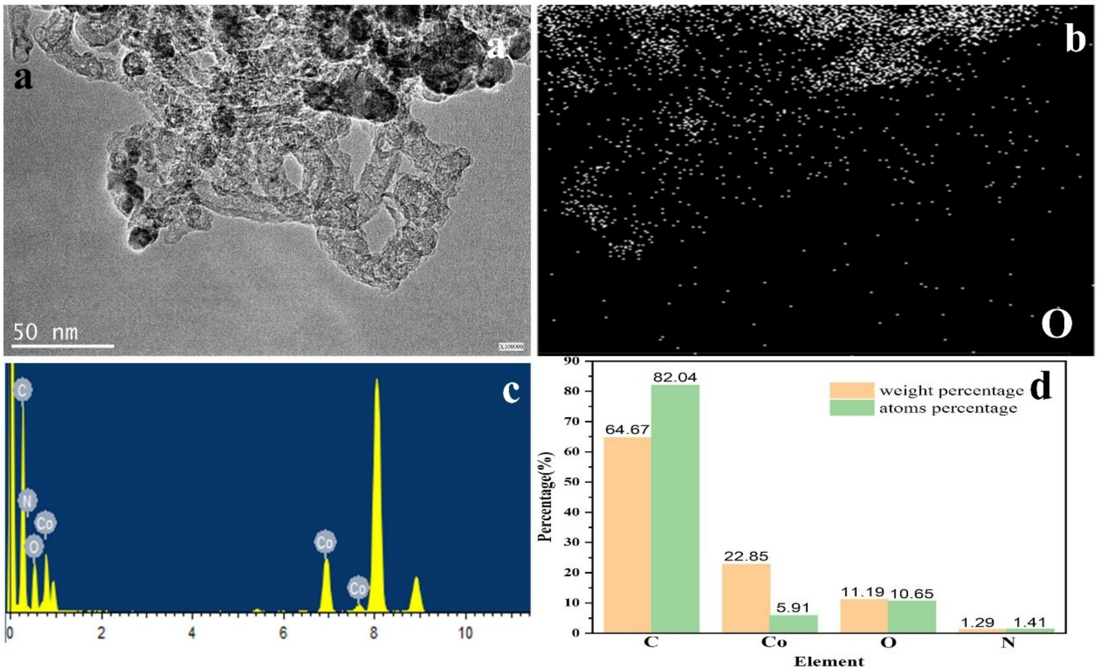


Fig. S6 (a) TEM of Co@Co_3O_4-G. (b) TEM-EDS elemental mapping of O atom in Co@Co_3O_4-G. (c) The corresponding EDS spectrum of Co@Co_3O_4-G. (d) The weight and atoms percentage of C, Co, O and N in the Co@Co_3O_4-G.

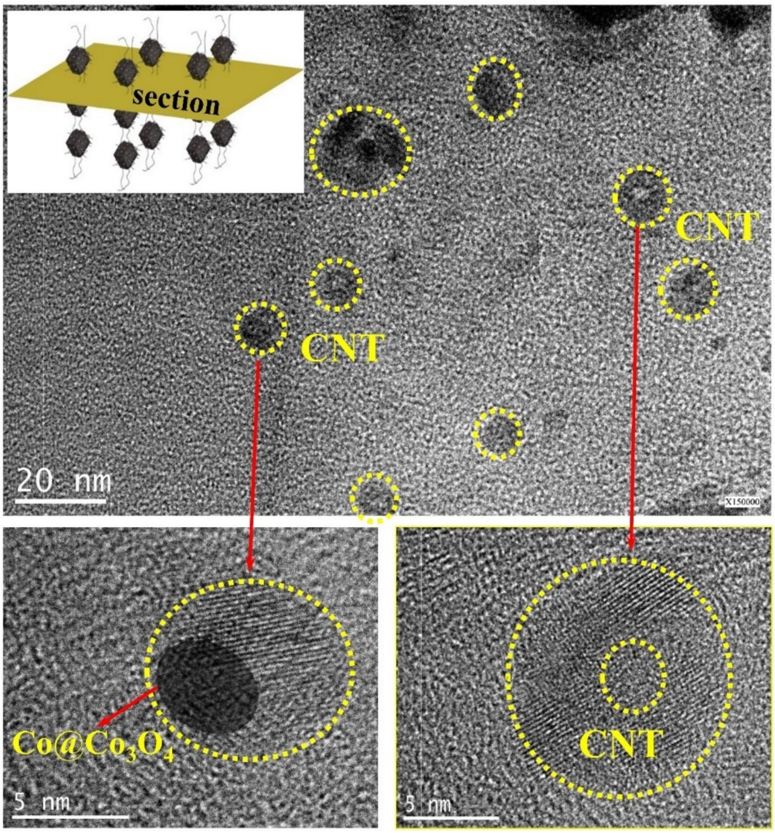


Fig. S7 The HRTEM of ultra-thin section of ER/Co@Co_3O_4-G with 8.7 vol% loading of Co@Co_3O_4-G.

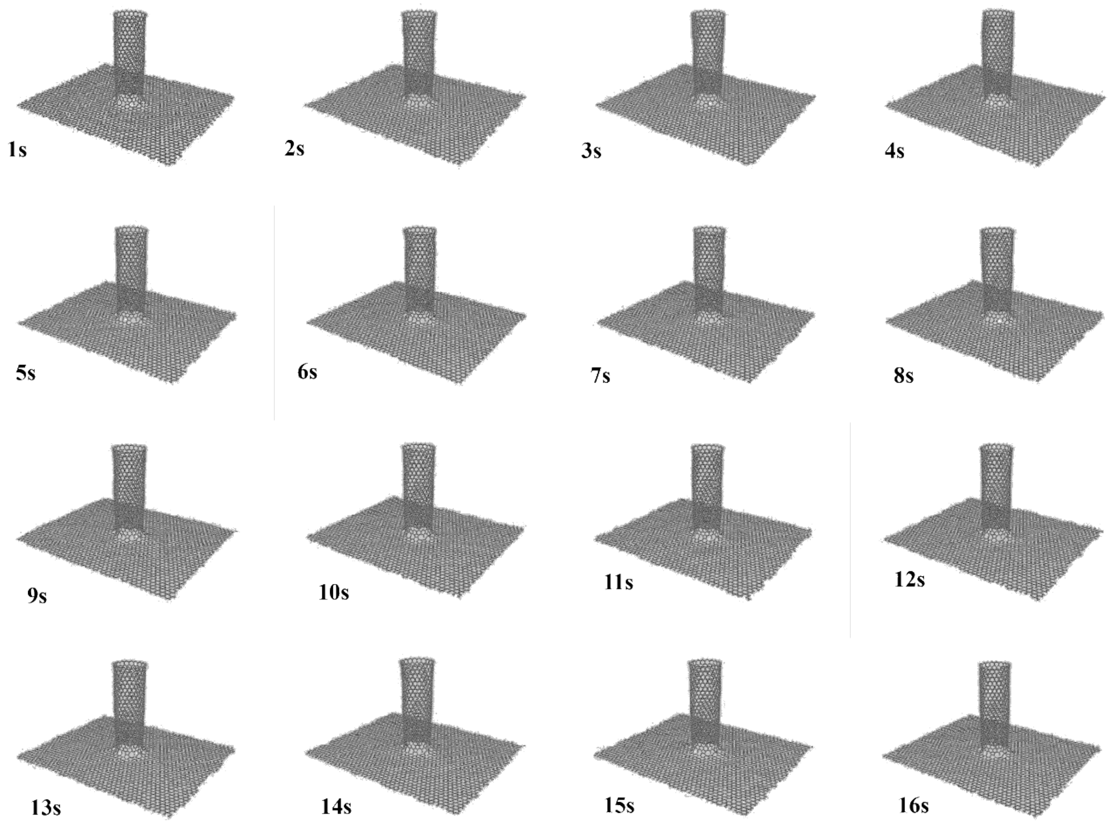


Fig. S8 the atomic vibrogram of G∩CNT with time in EMD simulate.

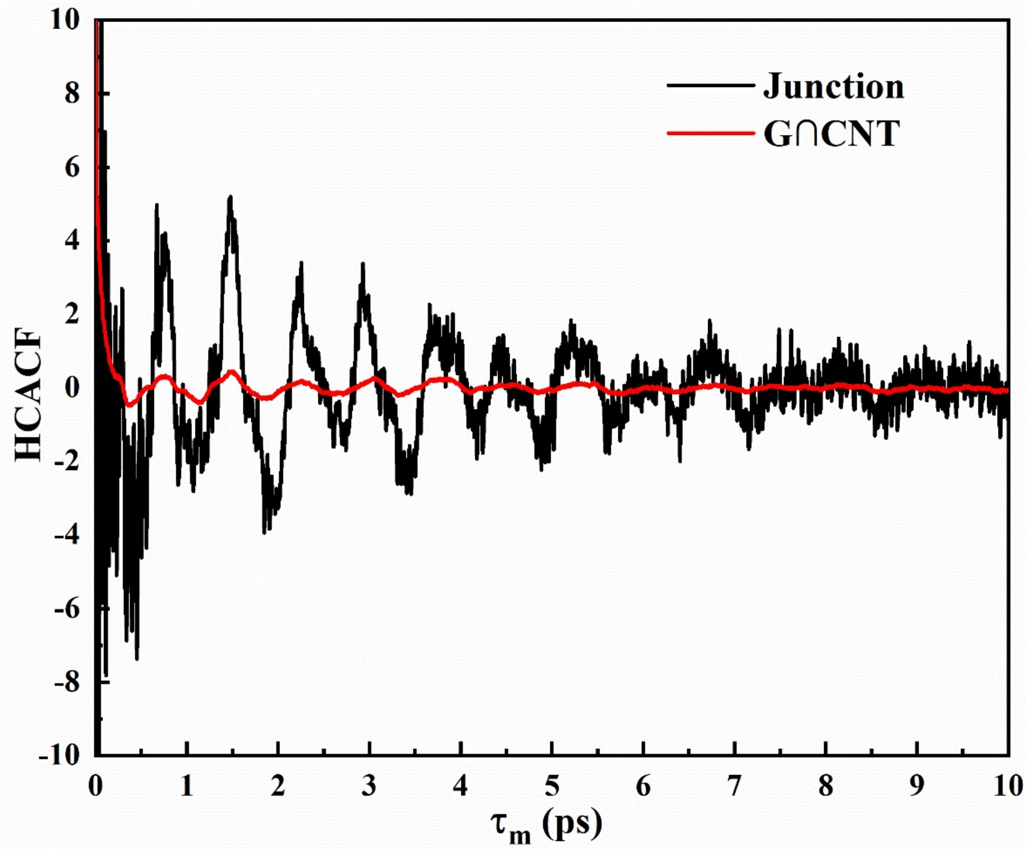


Fig. S9 The change of HCACF of the G∩CNT and the junction with time.

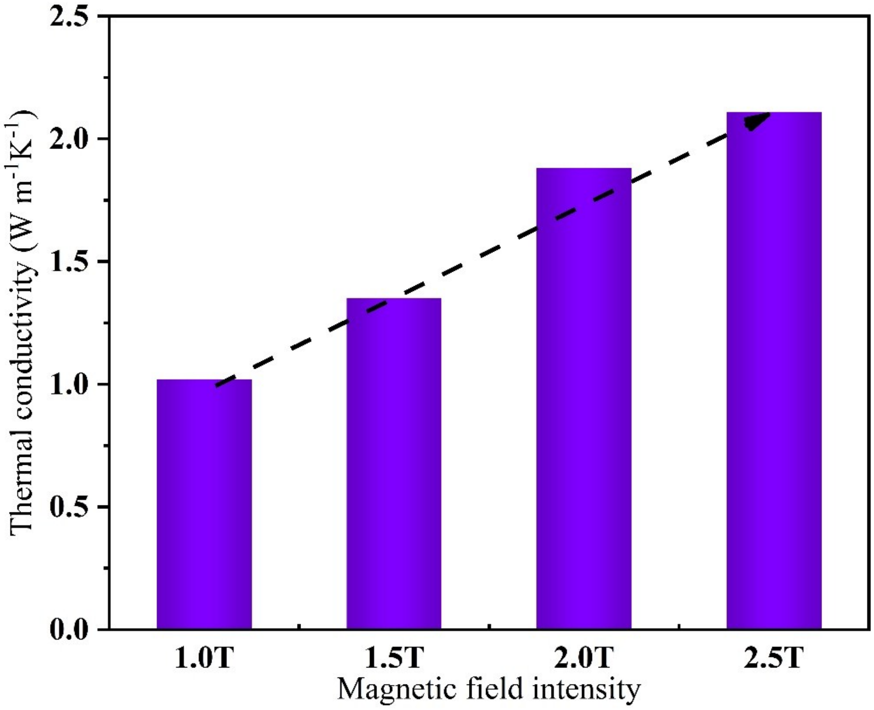


Fig. S10 The thermal conductivity of nanocomposites with 8.7 vol% loading with the change of magnetic field intensity

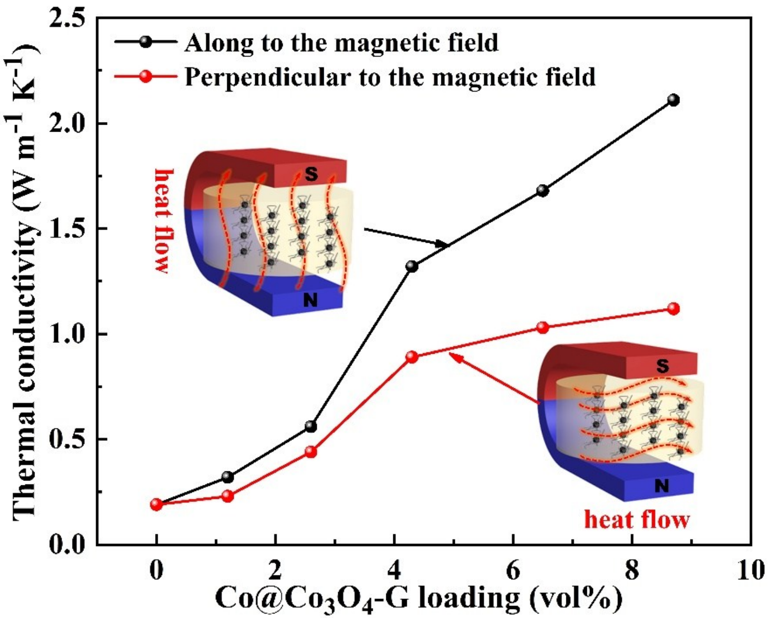
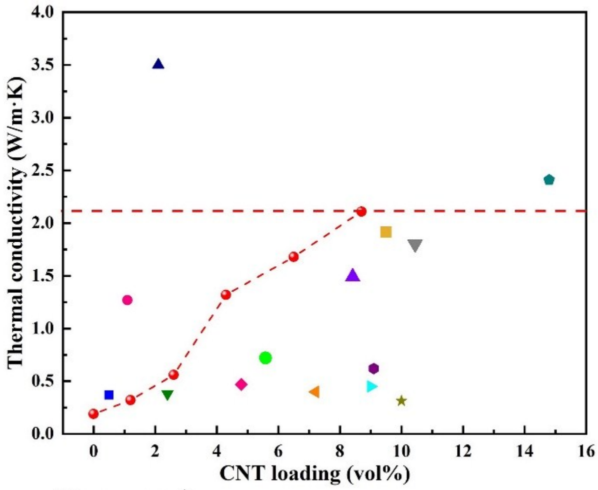


Fig. S11 the thermal conductivity of ER/Co@Co_3O_4-G with different loading along different heat flow.



ER: epoxy resin,
PE: polyethylene
PC: polycarbonate resin
PMMA: poly(methyl methacrylate)
PVDF:poly(vinylidene fluoride)

	CNT	Matrxi	Reference
	Multi-walled	ER	This work
	Single wall	PE	1
	Multi-walled	PC	2
	Multi-walled	PMMA	3
	Single wall	ER	4
	Multi-walled	PVDF	5
	Single wall	PMMA	6
	Multi-walled	ER	7
	Single wall	PMMA	8
	Single wall	PVDF	9
	Multi-walled	ER	10
	Graphene (G)		
	G and copper	ER	11
	G and BN	ER	12
	Few-layer G	ER	13
	G and BN	ER	14

Fig. S12 Thermal conductivity of the ER/Co@Co_3O_4-G nanocomposites with different loading and other CNT and graphene-based composites reported in previous work.

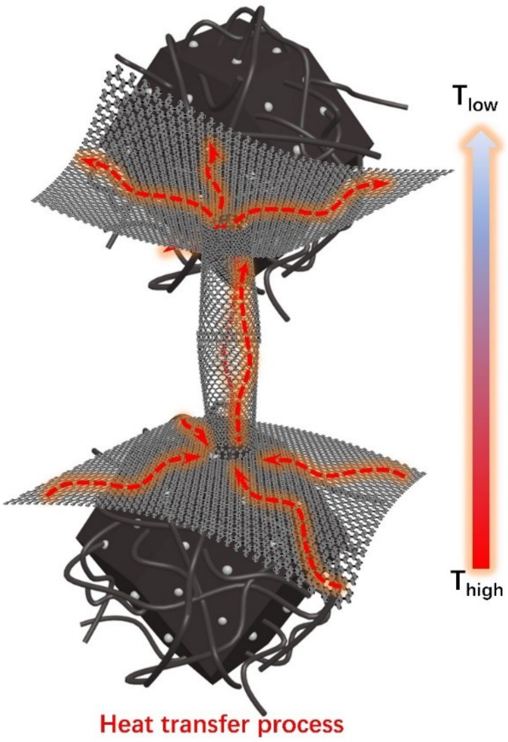


Fig. S13 The thermal conductive mechanism of $Co@Co_3O_4$-G.

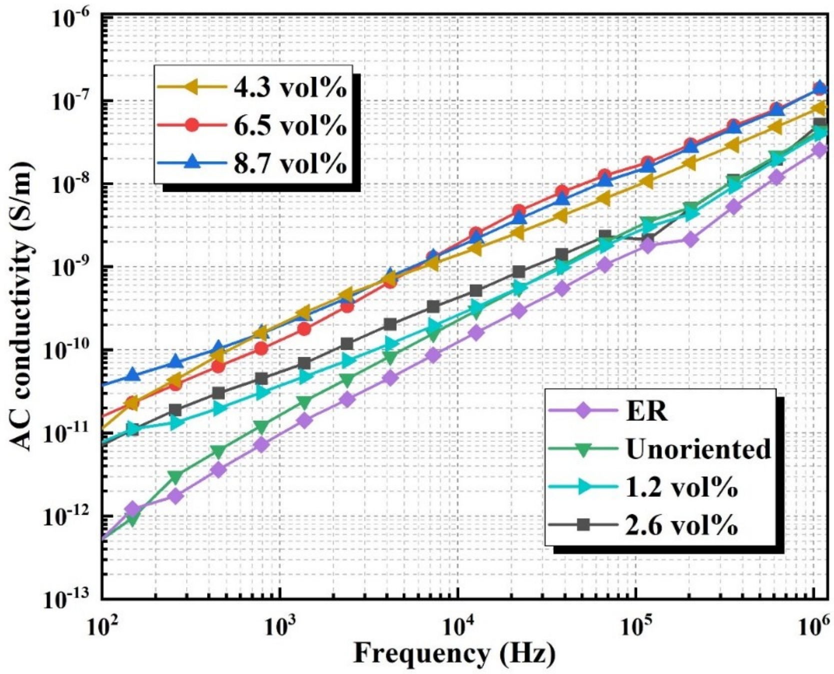


Fig. S14 Frequency dependence of electric conductivity of the nanocomposites with different loading.

Reference

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