Electronic Supplementary Material

Excellent lightweight carbon-based microwave absorbers derived from metal-organic frameworks with tunable electromagnetic properties

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The number of Pages, Figures, and Tables are 7, 5, 1, respectively.

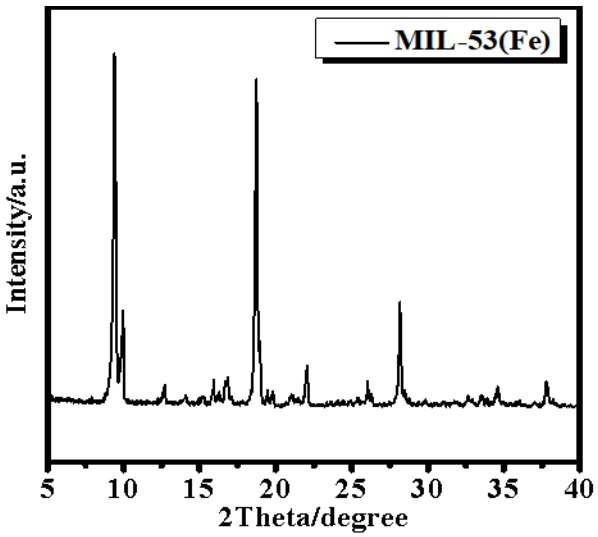

Fig. S1. XRD pattern of MIL-53(Fe) precursor.

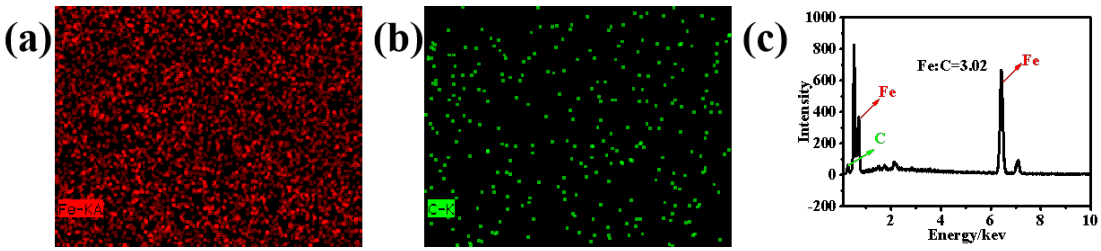

Fig. S2. (a) Fe and (b) C element EDS mapping of S750 sample. (c) EDS of S750.

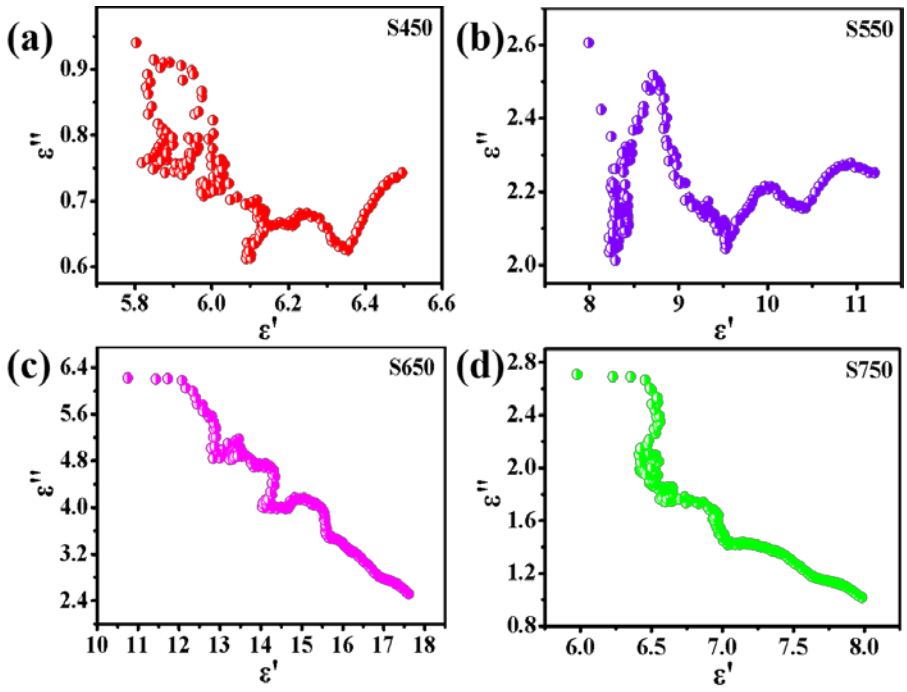

Fig. S3. Cole-Cole curves of (a) S450, (b) S550, (c) S650 and (d) S750/paraffin composites.

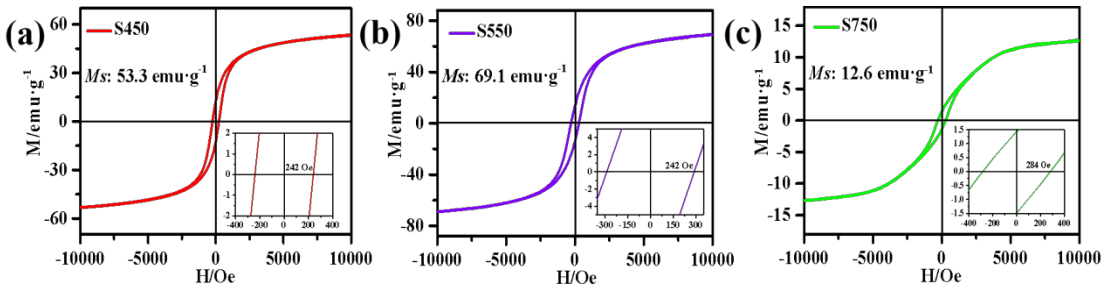

Fig. S4. M−H loops of (a) S450, (b) S550 and (c) S750 measured at room temperature.

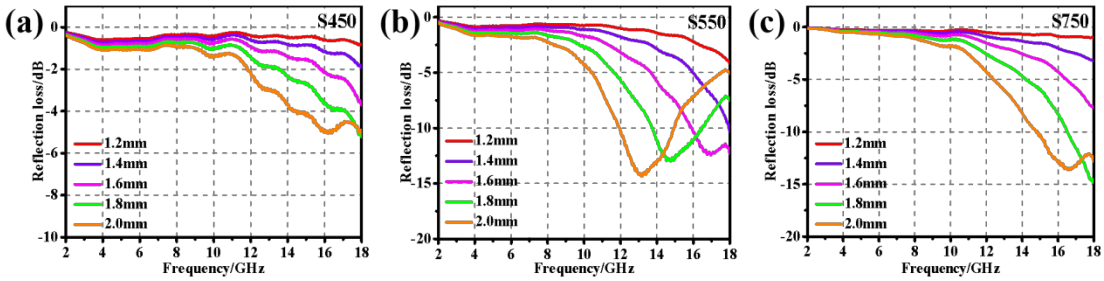

Fig. S5. Reflection loss values versus frequency of (a) S450, (b) S550 and (c) S750.

The operation of Gibbs free energy part:

The transformation reaction from Fe_3O_4 crystal to Fe_3C crystal can be showed as:[1, 2]

$$Fe_3O_4 + C \rightarrow Fe_3C + 2O_2 \quad (1)$$

$$\Delta G_T^{\theta} = \Delta H_T^{\theta} - T\Delta S_T^{\theta} \quad (2)$$

$$d\Delta S_T^{\theta} = (\Delta Cp/T)\, dT \quad (3)$$

Based on practical inorganic thermodynamic data manual, we can draw a table as following.

Table. S1. Gibbs free energy of the materials. (ΔG: J/mol)

Temperature	ΔG(Fe_3O_4)	ΔG(C)	ΔG(Fe_3C)	ΔG(O_2)	ΔG(reaction)
900K (≈600 ºC)	226.083	167.053	151.687	109.255	195.571
1000K (≈700 ºC)	241.034	168.555	160.119	110.017	-28.65

According to the classical algorithm: $\Delta G(T) = \Delta G(T_1) + \frac{\Delta G(T_2) - \Delta G(T_1)}{T_2 - T_1} \times (T - T_1)$, where T_1 and T_2 stand for known temperature, ΔG means Gibbs free energy. We set T_1=600 ºC, T_2=700 ºC and ΔG=0, then the T value can be calculated as 689 ºC via utilizing the relevant data in the above table.

1. Z. Lou, C. Yuan, Y. Zhang, Y. Li, J. Cai, L. Yang, W. Wang, H. Han and J. Zou, Synthesis of porous carbon matrix with inlaid Fe_3C/Fe_3O_4 micro-particles as an effective electromagnetic wave absorber from natural wood shavings. *J. Alloys Compd.*, 2019, **775**, 800-809.

2. J. Marques, A. Costa, C. Pereira, Gibbs free energy (ΔG) analysis for the Na-O-H (sodium-oxygen-hydrogen) thermochemical water splitting cycle. *Int. J. Hydrogen energy*, 2019, **44**, 14536-14549.