Polyimide aerogel derived amorphous porous carbon/crystalline carbon composites for high performance microwave absorption

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Electronic Supplementary Information (ESI)

S1. Permeability of PIC, PIC/rGO and PIC/CNT, and magnetic tangent loss of PIC, PIC/rGO and PIC/CNT.

The μ′ and μ″ of the three groups of PIC, PIC/rGO and PIC/CNT samples are basically the same, and μ′ is around 1 and μ″ is around 0, as shown in Fig. S1a. It shows that the material has almost no magnetic loss characteristics. As shown in Fig. S1b, the taδμ of all three sets of samples is around 0, which further proves that the magnetic loss capability of the material is negligible.

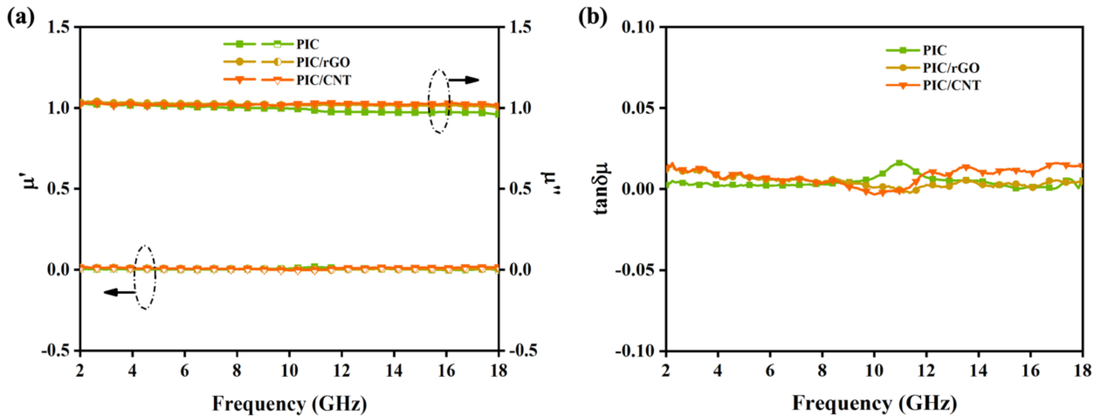

Fig.S1 (a) Permeability of PIC, PIC/rGO and PIC/CNT; (b) magnetic tangent loss of PIC, PIC/rGO and PIC/CNT.

S2. The plot of ε'' versus ε' for PIC, PIC/rGO and PIC/CNT .

The Cole-Cole diagram can describe the dielectric polarization properties of the material. As shown in Figure S2, there is only one Debyeu pole relaxation process in all three sets of samples. The radii of PIC/rGO and PIC/CNT arcs are significantly larger than those of PIC, indicating that the first two have stronger dipole relaxation processes. The reason why PIC/rGO and PIC/CNT have higher dielectric loss than PIC is answered.

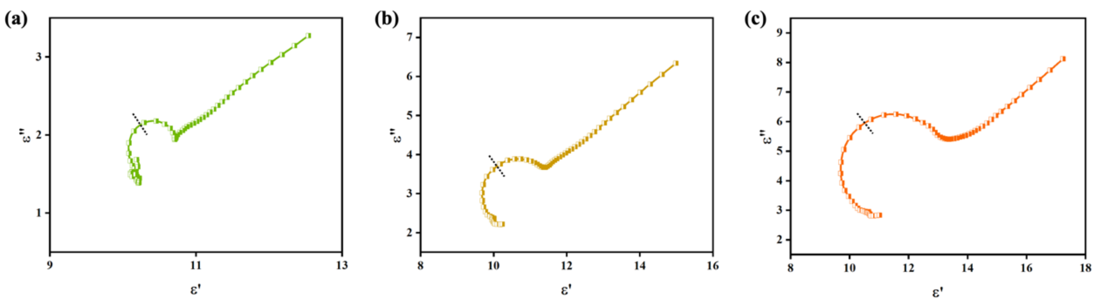

Fig.S2 (a) The plot of ε'' versus ε' for PIC; (b) The plot of ε'' versus ε' for PIC/rGO; (c) The plot of ε'' versus ε' for PIC/CNT.

S3. 3D simulations of the RL values of electromagnetic wave absorption for PIC in the frequency range of 2-18 GHz and thickness range of 1.5-5.5 mm.

The PIC samples showed some wave absorption performance, but it was poor compared to PIC/rGO and PIC/CNT. As shown in Figure S3, the RLmin and EABW of PIC are −34.01 dB and 1.76 GHz (16.24-18.00 GHz). This shows that the effect of crystalline carbon content on the absorbing properties of the material is significant.

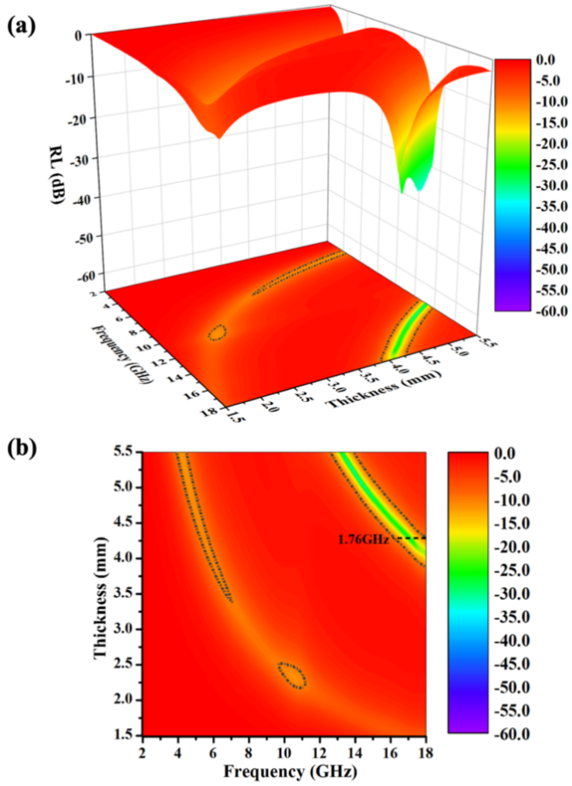

Fig. S3 3D simulations of the RL values of electromagnetic wave absorption for PIC in the frequency range of 2-18 GHz and thickness range of 1.5-5.5 mm.

S4. 2D schematic of the EMW absorption performance of PIC at 2-18 GHz, simulated thickness versus peak frequency of PIC at 2-18 GHz and relationship between EMW frequencies of PIC at 2-18 GHz and Zin/Zo.

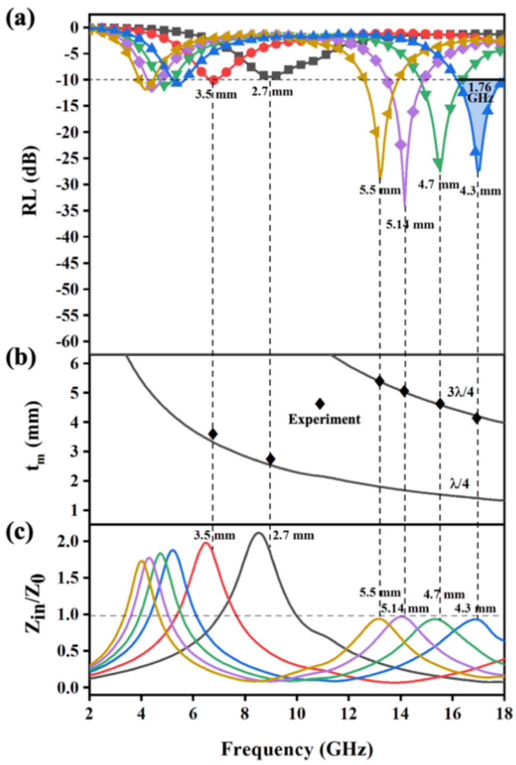

Fig.S4 (a) 2D schematic of the EMW absorption performance of PIC at 2-18 GHz; (b) Simulated thickness versus peak frequency of PIC at 2-18 GHz; (c) Relationship between EMW frequencies of PIC at 2-18 GHz and Zin/Zo.

S5. Purity and source of raw materials.

Table.S5 Purity and source of raw materials.

Raw material	Purity(wt%)	Source
ODA	≥99%	MACKLIN
PMDA	≥99%	MACKLIN
DMAc	≥99.8%	MACKLIN
TEA	≥99.5%	MACKLIN
Acetone	≥99.5%	MACKLIN
rGO	≥99%	TIME NANO
CNT	≥98%	TIME NANO