**Supporting Information**

Ultra-broadband microwave absorber and high-performance pressure sensor based on aramid nanofiber, polypyrrole and nickel porous aerogel

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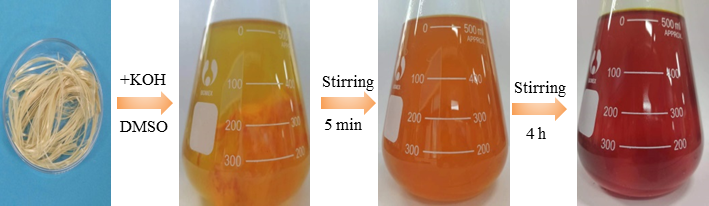
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Fig. S1. Preparation of ANF dispersion.

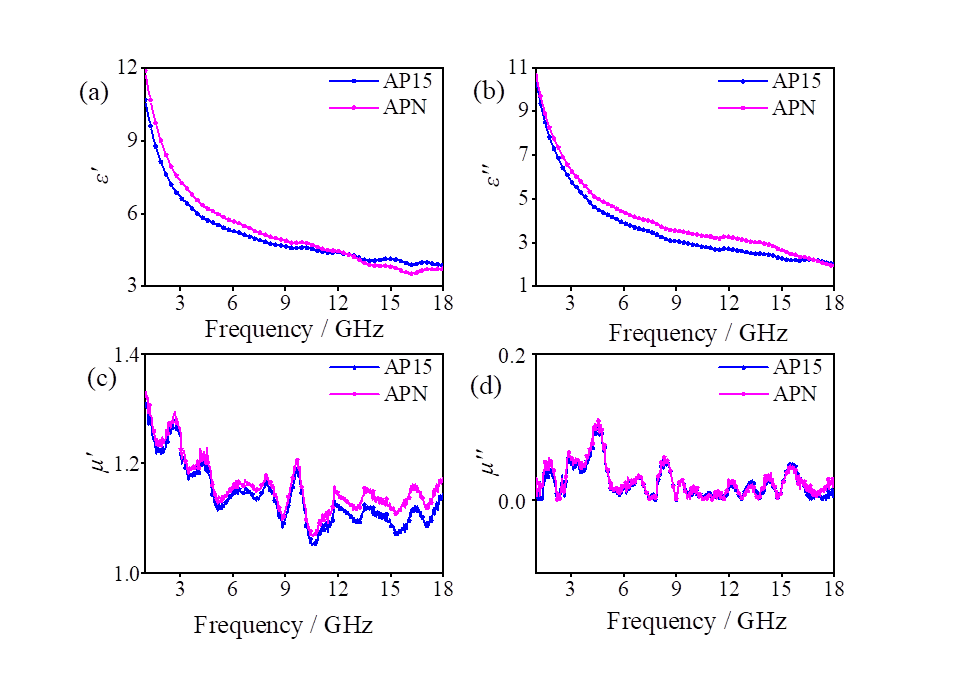


Fig. S2. (a) Real permittivity (*ε'*), (b) imaginary permittivity (*ε"*), (c) real permeability(*µ'*), and (d) imaginary permittivity (*µ"*) of AP15 and APN.

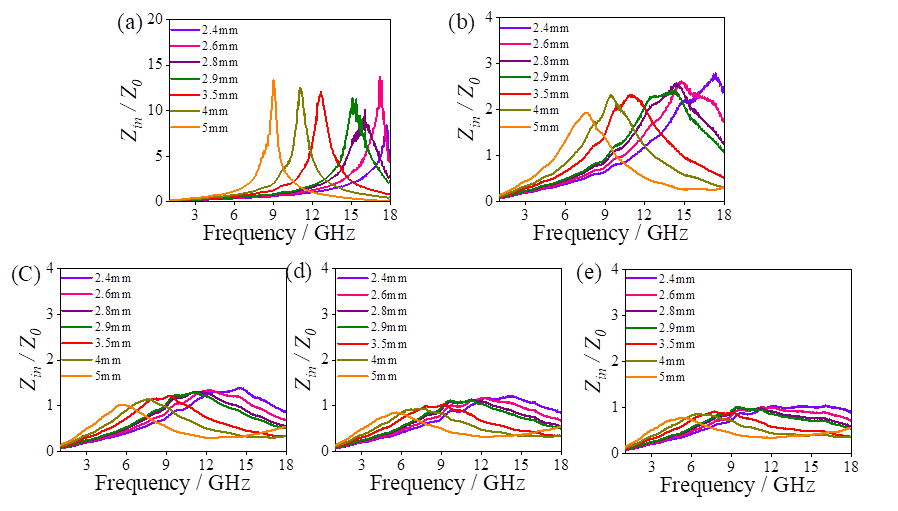
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Fig. S3. Impedance matching at optimum thickness of (a) AP31; (b) AP11; (c) AP13; (d) AP15; (e) APN aerogel in the frequency range of 1~18 GHz.

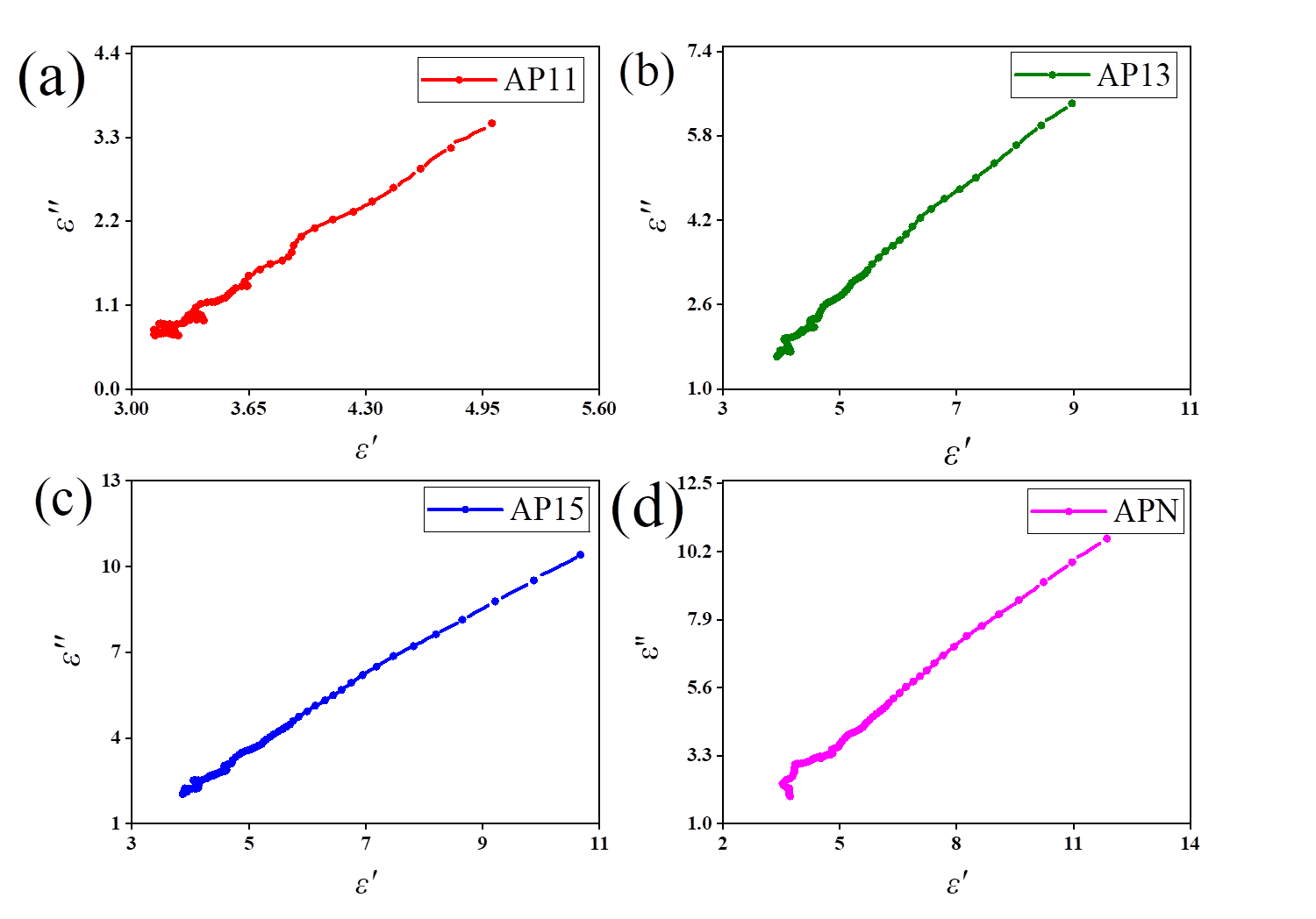


Fig. S4. Cole-Cole curve: (a) AP11; (b) AP13; (c) AP15; (d) APN.

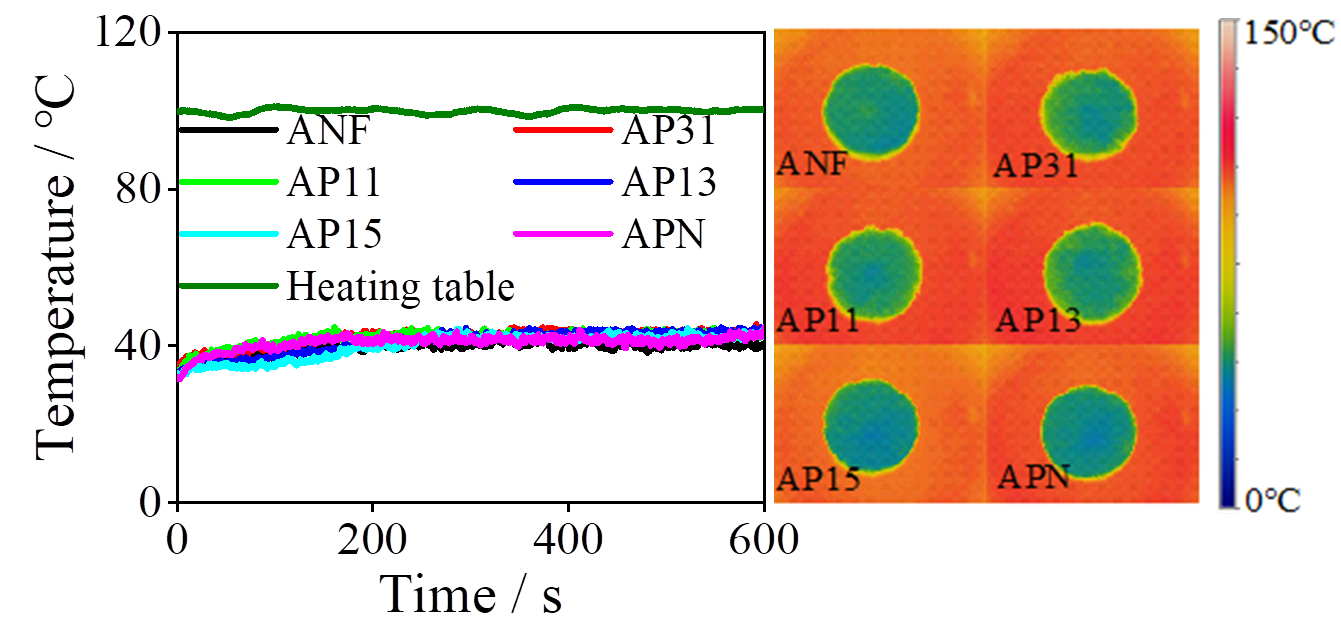
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Fig. S5. Temperature-time curves and optical photographs taken with an infrared camera from the top of the aerogel on a heating stage at 100°C.

Table S1. Table of elemental content of C and Ni

|  |  |
| --- | --- |
| Element | at% |
| C | 97.99 |
| Ni | 2.01 |

Table S2. Comparison of the EMA properties in this work with those of other composites in previous studies

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| sample | Filling Content (wt%) | Thickness (mm) | Bandwidth (GHz) | RLmin  (dB) | Ref. |
| AP13 aerogel | 10 | 2.9  5 | 5.82  3.49 | -20.6  -47.9 | This Work |
| AP15 aerogel | 10 | 2.9  2.6 | 7.18  6.55 | -35.1  -52 |
| APN aerogel | 10 | 2.8  2.4 | 8.4  6.24 | -20.7  -48.7 |
| Fe3O4/Fe3S4 | 70 | 1.71 | 5.18 | 16.23 | 1 |
| rGO/Nb2CTx/Fe3O4 | 50 | 2.5 | 6.8 | 59.17 | 2 |
| Brconical prisms Ni@C | 40 | 2.4 | 4.4 | -52.9 | 3 |
| Co@CoO | 25 | 1.65 | 3.6 | 62.76 | 4 |
| Fe4N@C | 40 | 2.5 | 6.7 | -42 | 5 |
| Ni/Ni3ZnC0.7/C | 20 | 2 | 5.4 | -40.2 | 6 |
| BCN/C/Co | 48 | 2.3 | 6.6 | -19.6 | 7 |
| 3D Co/N-GCT | 25 | 2 | 3.2 | -- | 8 |
| BN/Ni | 48 | 1.7 | 3 | -- | 9 |
| FMCM | 40 | 2 | 6.5 | -41.9 | 10 |
| Cu3(HHTP)2 | 40 | 2.1 | 5.76 | -43.5 | 11 |
| B4C@GN NSs | 50 | 1.19 | 3.9 | -24.6 | 12 |
| SnO/SnO2 | 25 | 1.4 | 4.3 | -37.6 | 13 |
| Co@C/CG aerogel | 30 | 1.5 | 4.02 | 45.02 | 14 |
| Fe3O4/CA aerogel | 10 | 1.8 | 5.2 | -57 | 15 |
| CNTs@ZIS/CNF aerogel | 2 | 2.7 | 5.8 | -- | 16 |
| C@NiCo2O4 aerogel | 50 | 1.85  4.09 | 5.7  -- | --  -54.6 | 17 |
| TiO2/Ti3C2Tx/RGO aerogel | 10 | 2  2.5 | 4.3  1 | --  -65.3 | 18 |
| CNTs/Fe3O4 aerogel | 50 | 1.4 | 4 | -33.7 | 19 |
| CeO2/porous carbon aerogel | 20 | 2.1 | 5.28 | -- | 20 |
| Shaddock peel-based carbon aerogel | 20 | 1.7 | 5.8 | -29.5 | 21 |

**Referance**

[1] H.J. Wu, J.L. Liu, H.S. Liang, and D.Y. Zang, Sandwich-like Fe3O4/Fe3S4 composites for electromagnetic wave absorption, *Chem*. *Eng*. *J*., 393(2020), art. No. 124743.[2] C. Cui, R.H. Guo, E.H. Ren, *et al.*, MXene-based rGO/Nb2CT*x*/Fe3O4 composite for high absorption of electromagnetic wave, *Chem*. *Eng*. *J*., 405(2021), art. No. 126626.[3] X. Li, Z.L. Wang, Z. Xiang, *et al.*, Biconical prisms Ni@C composites derived from metal-organic frameworks with an enhanced electromagnetic wave absorption, *Carbon*, 184(2021), p. 115.[4] Y. Shu, T.K. Zhao, X.H. Li, *et al.*, Surface plasmon resonance-enhanced dielectric polarization endows coral-like Co@CoO nanostructures with good electromagnetic wave absorption performance, *Appl*. *Surf*. *Sci*., 585(2022), art. No. 152704.[5] X.C. Liang, C.G. Wang, M.J. Yu, Z.Q. Yao, and Y. Zhang, Fe-MOFs derived porous Fe4N@carbon composites with excellent broadband electromagnetic wave absorption properties, *J*. *Alloys Compd*., 910(2022), art. No. 164844.[6] Q.L. Chang, C.P. Li, J. Sui, G.I.N. Waterhouse, Z.M. Zhang, and L.M. Yu, Ni/Ni3ZnC0.7 modified alginate-derived carbon composites with porous structures for electromagnetic wave absorption, *Carbon*, 200(2022), p. 166.[7] H.Y. Tian, J. Qiao, Y.F. Yang, *et al.*, ZIF-67-derived Co/C embedded boron carbonitride nanotubes for efficient electromagnetic wave absorption, *Chem*. *Eng*. *J*., 450(2022), art. No. 138011.[8] X.C. Zhang, X. Zhang, H.R. Yuan, *et al.*, CoNi nanoparticles encapsulated by nitrogen-doped carbon nanotube arrays on reduced graphene oxide sheets for electromagnetic wave absorption, *Chem*. *Eng*. *J*., 383(2020), art. No. 123208.[9] Y.H. Zhang, H.X. Si, S.C. Liu, Z.Y. Jiang, J.W. Zhang, and C.H. Gong, Facile synthesis of BN/Ni nanocomposites for effective regulation of microwave absorption performance, *J*. *Alloys Compd*., 850(2021), art. No. 156680.[10] Y.H. Cui, K. Yang, J.Q. Wang, T. Shah, Q.Y. Zhang, and B.L. Zhang, Preparation of pleated RGO/MXene/Fe3O4 microsphere and its absorption properties for electromagnetic wave, *Carbon*, 172(2021), p. 1.[11] Z. Shan, S.Y. Cheng, F. Wu, *et al.*, Electrically conductive two-dimensional metal-organic frameworks for superior electromagnetic wave absorption, *Chem*. *Eng*. *J*., 446(2022), art. No. 137409.[12] B.X. Zhang, T. Prikhna, C.P. Hu, and Z.J. Wang, Graphene-layer-coated boron carbide nanosheets with efficient electromagnetic wave absorption, *Appl*. *Surf*. *Sci*., 560(2021), art. No. 150027.[13] H.P. Lv, C. Wu, J. Tang, *et al.*, Two-dimensional SnO/SnO2 heterojunctions for electromagnetic wave absorption, *Chem*. *Eng*. *J*., 411(2021), art. No. 128445.[14] J. Xu, X. Zhang, Z.B. Zhao, *et al.*, Lightweight, fire-retardant, and anti-compressed honeycombed-like carbon aerogels for thermal management and high-efficiency electromagnetic absorbing properties, *Small*, 17(2021), No. 33, art. No. 2102032.[15] X.K. Lu, D.M. Zhu, X. Li, and Y.J. Wang, Architectural design and interfacial engineering of CNTs@ZnIn2S4 heterostructure/cellulose aerogel for efficient electromagnetic wave absorption, *Carbon*, 197(2022), p. 209.[16] Y.Y. Dong, X.J. Zhu, F. Pan, *et al.*, Implanting NiCo2O4 equalizer with designable nanostructures in agaric aerogel-derived composites for efficient multiband electromagnetic wave absorption, *Carbon*, 190(2022), p. 68.[17] Y. Tong, M. He, Y.M. Zhou, *et al.*, Three-dimensional hierarchical architecture of the TiO2/Ti3C2T*x*/RGO ternary composite aerogel for enhanced electromagnetic wave absorption, *ACS* *Sustainable Chem*. *Eng*., 6(2018), No. 7, p. 8212.[18] Y.L. Ma, Y.B. Li, X. Zhao, *et al.*, Lightweight and multifunctional super-hydrophobic aramid nanofiber/multiwalled carbon nanotubes/Fe3O4 aerogel for microwave absorption, thermal insulation and pollutants adsorption, *J*. *Alloys Compd*., 919(2022), art. No. 165792.[19] X.M. Huang, X.H. Liu, Z.R. Jia, B.B. Wang, X.M. Wu, and G.L. Wu, Synthesis of 3D cerium oxide/porous carbon for enhanced electromagnetic wave absorption performance, *Adv*. *Compos*. *Hybrid Mater*., 4(2021), No. 4, p. 1398.[20] W.H. Gu, J.Q. Sheng, Q.Q. Huang, G.H. Wang, J.B. Chen, and G.B. Ji, Environmentally friendly and multifunctional shaddock peel-based carbon aerogel for thermal-insulation and microwave absorption, *Nanomicro Lett*., 13(2021), No. 1, art. No. 102.[21] Z.W. Ye, K.J. Wang, X.Q. Li, and J.J. Yang, Preparation and characterization of ferrite/carbon aerogel composites for electromagnetic wave absorbing materials, *J*. *Alloys Compd*., 893(2022), art. No. 162396.