

Supporting Information

Highly Stretchable Composite Foams via Sustainable Utilization of Waste Tire Rubbers for Temperature-Dependent Electromagnetic Wave Absorption

Jiajia Zheng ¹, Mohammed Hanshe ¹, Weiwei He ¹, Tianyi Hang ¹, Zhihui Li ¹, Shaohua Jiang ², Shiju E ¹, Xiping Li ¹ and Yiming Chen ^{1,*}

¹ Key Laboratory of Urban Rail Transit Intelligent Operation and Maintenance Technology & Equipment of Zhejiang Province, College of Engineering, Zhejiang Normal University, Jinhua 321004, China; jiajia.zheng@zjnu.cn (J.Z.); nea526321@gmail.com (M.H.); hww9458@zjnu.edu.cn (W.H.); hangty@zjnu.edu.cn (T.H.); lizhihui@zjnu.edu.cn (Z.L.); eshiju@163.com (S.E); lxp2010@zjnu.cn (X.L.)

² Jiangsu Co-Innovation Center of Efficient Processing and Utilization of Forest Resources, International Innovation Center for Forest Chemicals and Materials, College of Materials Science and Engineering, Nanjing Forestry University, Nanjing 210037, China; shaohua.jiang@njfu.edu.cn

* Correspondence: yiming.chen@zjnu.edu.cn

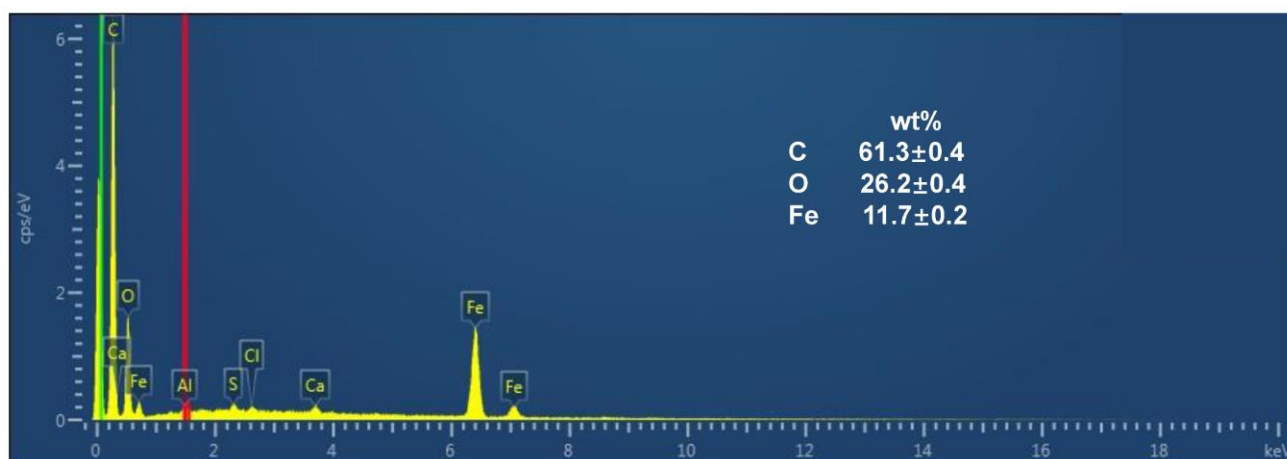


Figure S1. The EDS spectrum of the PU/WTR@CNT/Fe₃O₄ composite foam.

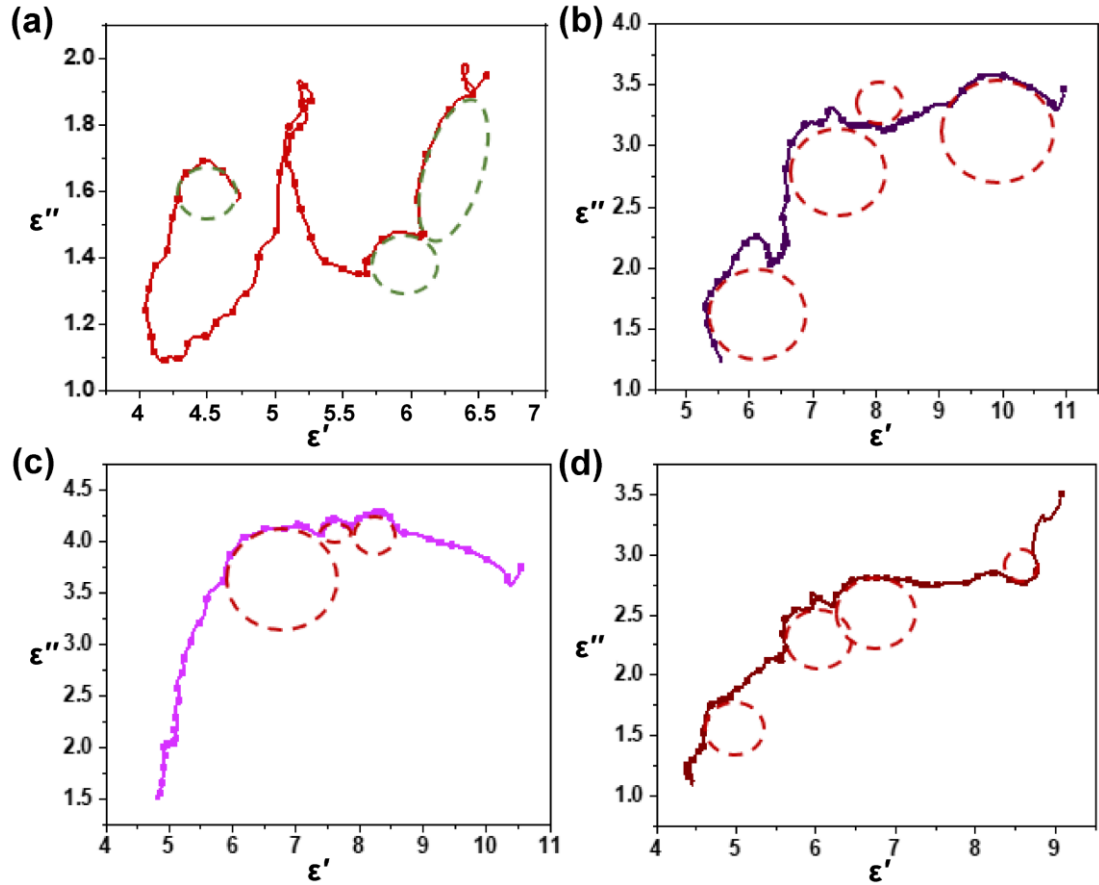


Figure S2. The Cole-Cole plots of the PU/@CNT/Fe₃O₄ and PU/WTR@CNT/Fe₃O₄ composite foams:

(a) PU/@CNT/Fe₃O₄, (b) PU/WTR@CNT/Fe₃O₄-1:1, (c) PU/WTR@CNT/Fe₃O₄-1:1.5, and (d) PU/WTR@CNT/Fe₃O₄-1:2.

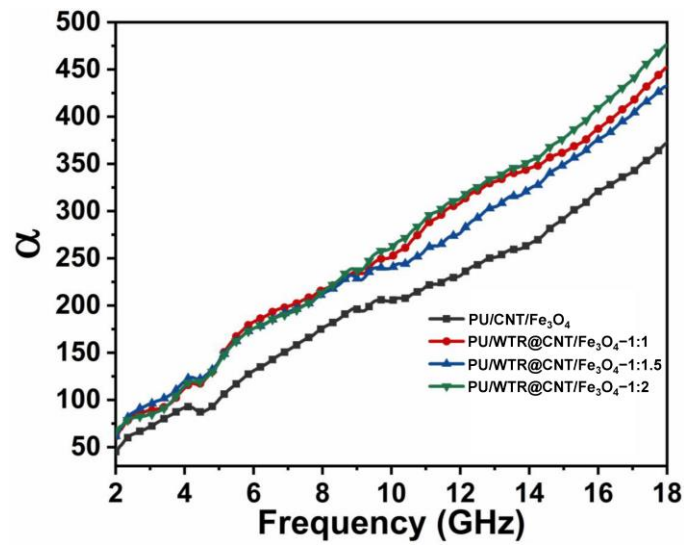


Figure S3. The attenuation constant (α) of the PU/@CNT/Fe₃O₄ and PU/WTR@CNT/Fe₃O₄ composite foams at different frequencies.

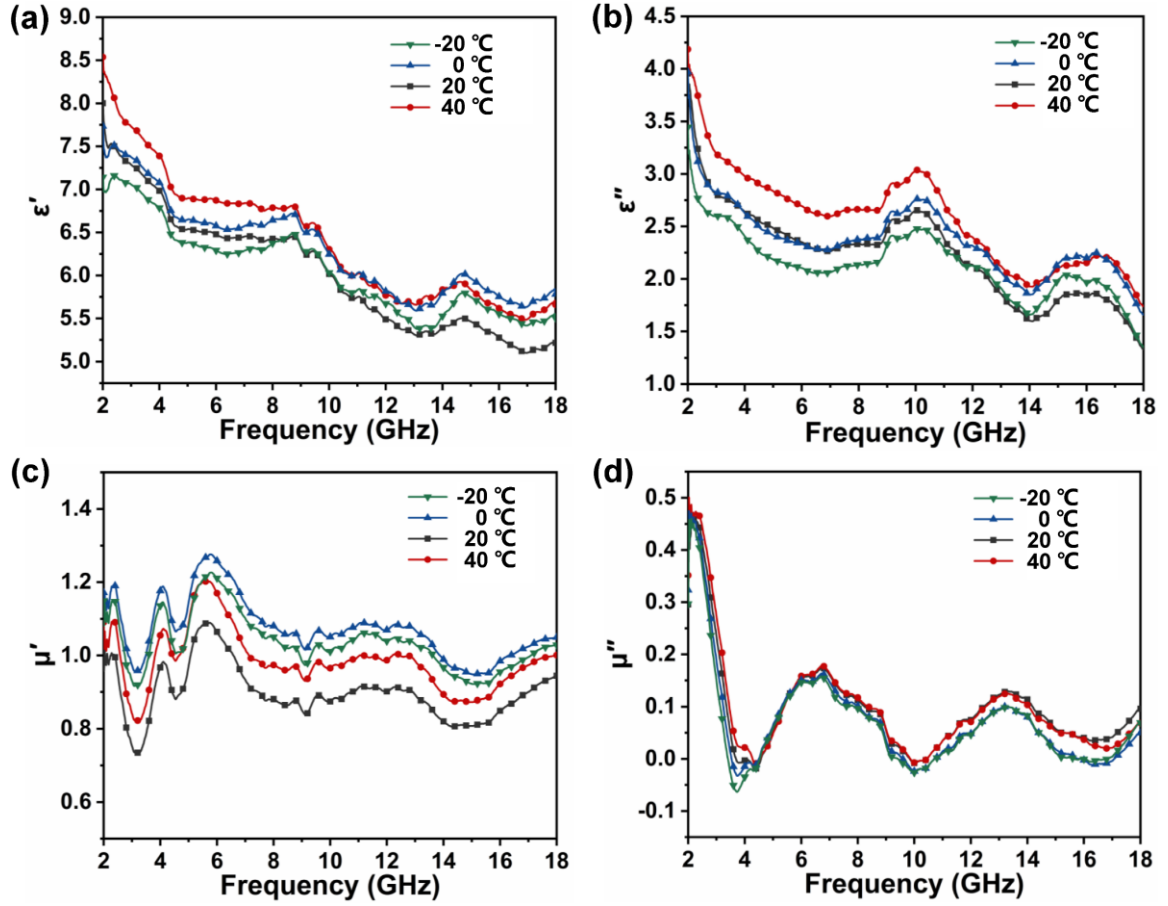


Figure S4. The (a) ε' , (b) ε'' , (c) μ' , and (d) μ'' of the PU/WTR@CNT/Fe₃O₄-1:2 composite foam at different temperatures.

$$\left(\varepsilon' - \frac{\varepsilon_s + \varepsilon_\infty}{2}\right)^2 + (\varepsilon'')^2 = \left(\frac{\varepsilon_s - \varepsilon_\infty}{2}\right)^2 \quad (S1)$$

Where ε_s and ε_∞ are the static dielectric and relative dielectric constant at the finite frequency, respectively [1].

The attenuation constant (α) can be calculated according to the following equation [2]:

$$\alpha = \frac{\sqrt{2}\pi f}{c} \sqrt{\mu''\varepsilon'' - \varepsilon'\mu' + \sqrt{(\mu''\varepsilon'' - \varepsilon'\mu')^2 + (\mu''\varepsilon' + \varepsilon'\mu')^2}} \quad (S2)$$

References

1. Levy, O.; Stroud, D. Maxwell Garnett theory for mixtures of anisotropic inclusions: Application to conducting polymers. *Phys. Rev. B* **1997**, *56*, (13), 8035-8046.
2. Chuai, D.; Liu, X.; Yu, R.; Ye, J.; Shi, Y. Enhanced microwave absorption properties of flake-shaped FePCB metallic glass/graphene composites. *Compos. Part A-Appl. S.* **2016**, *89*, 33-39.