Lightweight porous Co_3O_4 and Co/CoO nanofibers with tunable impedance match and configuration-dependent microwave absorption properties

Biao Zhao, [a, b, *] Jiushuai Deng, [c] Luyang Liang, [a] Chenyinxia Zuo,[b] Zhongyi Bai, [a] Xiaoqin Guo, [a] Rui Zhang, [a, *]

[a] Henan Key Laboratory of Aeronautical Materials and Application Technology, School of Mechatronics Engineering, Zhengzhou University of Aeronautics, Zhengzhou, Henan 450046, China

[b] Department of Mechanical and Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, Ontario M5S 3G8, Canada

[c] State Key Laboratory of Complex Nonferrous Metal Resources Clean Utilization, Faculty of Land Resource Engineering, Kunming University of Science and Technology, Kunming 650093, China

* ***Corresponding Author:***

Dr. Biao Zhao

E-mail address: zhaobiao1813@163.com

Prof. Rui Zhang

E-mail address: zhangray@zzia.edu.cn

Tel: +86-371-60632007

Fax: +86-371-60632600

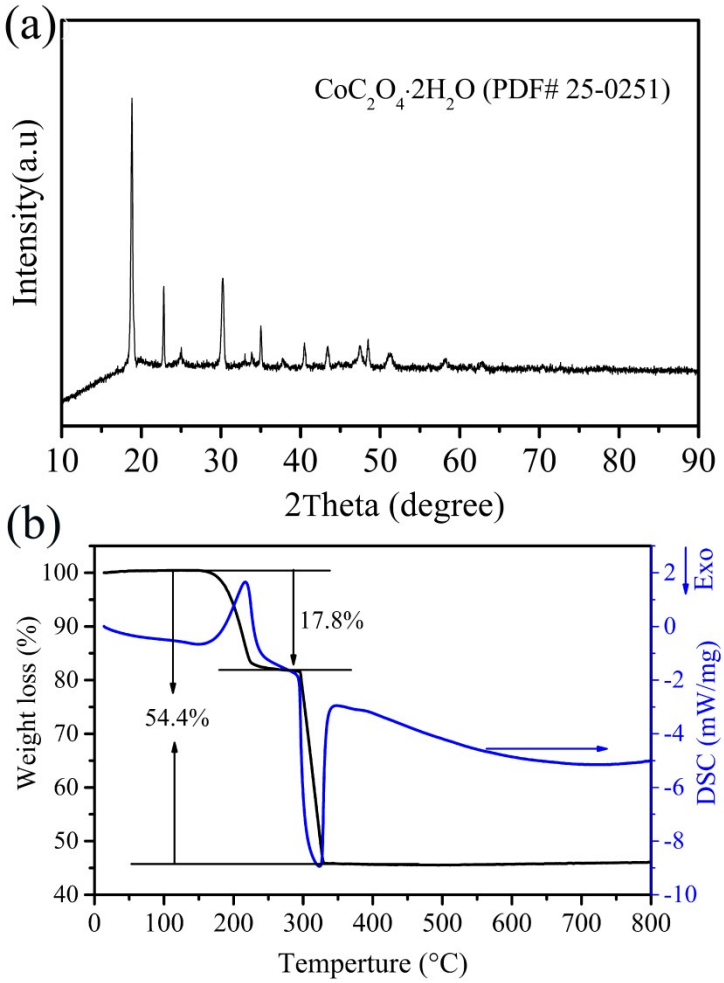

Figure S1 (a) XRD profile of precursor and (b) TG-DSC profile of CoC_2O_4 precursor calcined in air atmosphere

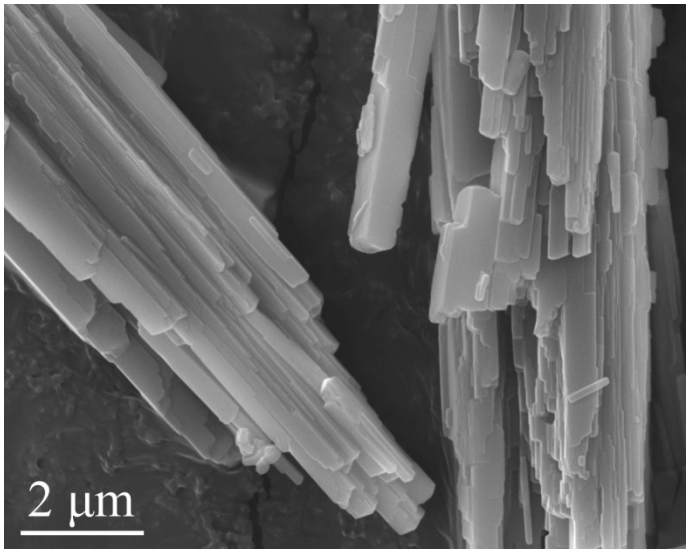

Figure S2 FESEM image of CoC_2O_4 precursor

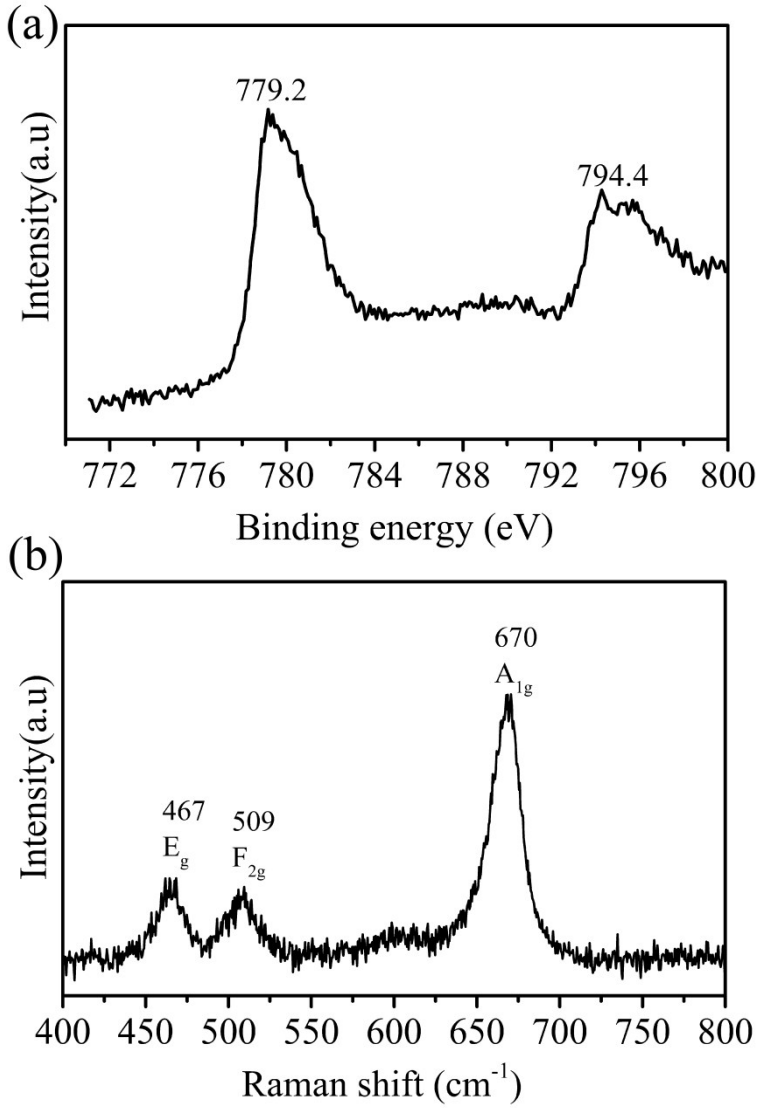

Figure S3 (a) High-resolution XPS core spectrum for Co 2p and (b) Raman pattern of S400 sample

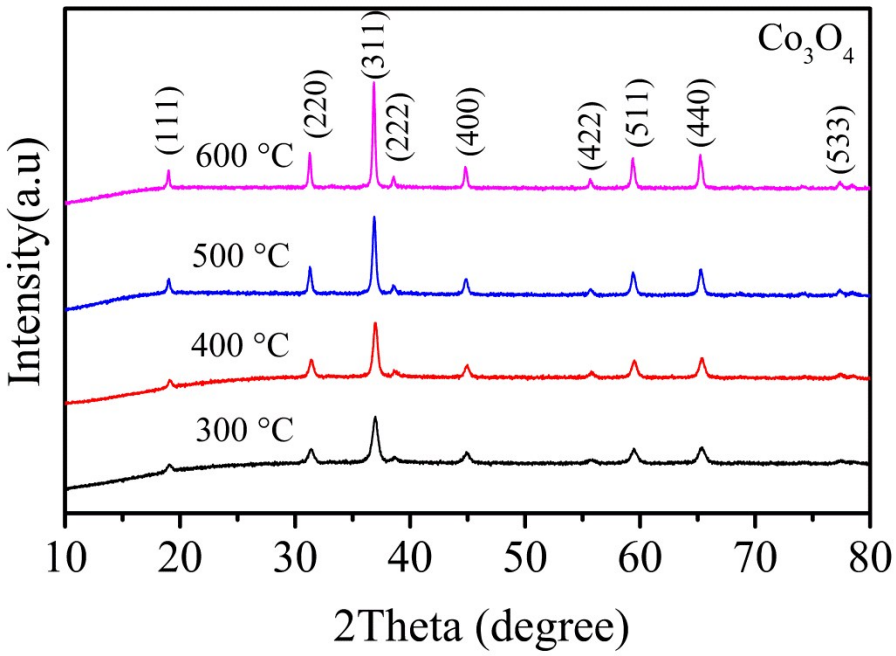

Figure S4 XRD patterns of porous Co_3O_4 nanofibers fabricated at different calcination temperatures

Table S1 Textural characteristics (surface area, pore size, pore volume) of porous Co_3O_4 nanofibers produced at different calcination temperature

Sample	**S_{BET} (m^2/g)**	**Pore volume) (cm^3/g)**	**Average pore size (nm)**
S300	57.86	0.273	18.4
S400	38.03	0.207	23.4
S500	26.50	0.126	21.7
S600	17.62	0.053	15.6

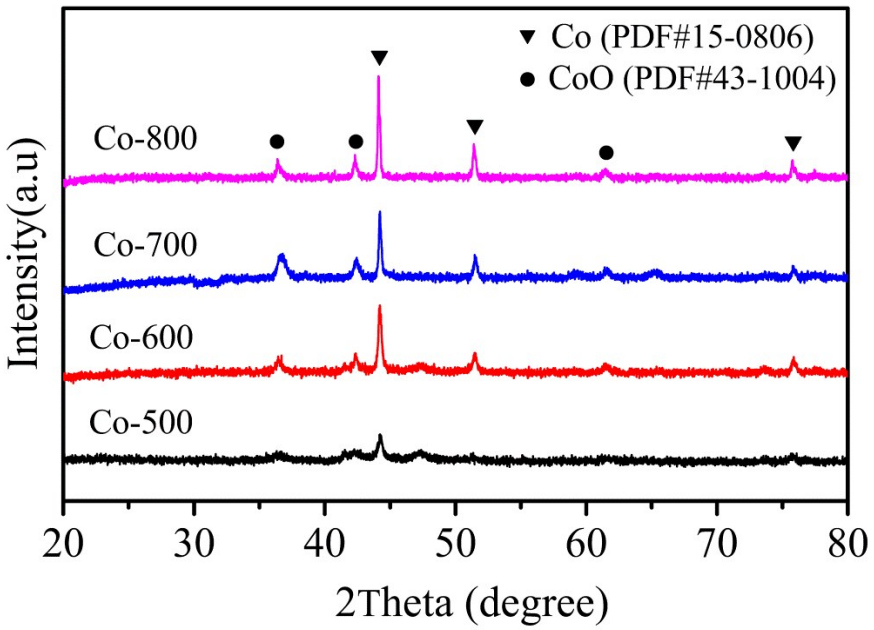

Figure S5 XRD curves of porous Co/CoO nanofibers prepared at different calcination temperatures under N_2 atmosphere

Table S2 Textural characteristics (surface area, pore size, pore volume) of porous Co_3O_4 nanofibers produced at different calcination temperature

Sample	**S_{BET} (m^2/g)**	**Pore volume) (cm^3/g)**	**Average pore size (nm)**
Co-500	25.01	0.124	19.0
Co-600	9.22	0.050	21.3
Co-700	8.54	0.046	21.0
Co-800	2.50	0.009	12.8

Table S3 Magnetic properties (Ms, Mr, Hc) of Co/CoO samples produced at different temperature

Sample	Ms (emu/g)	Mr (emu/g)	Hc (Oe)
Co-500	47.6	18.5	65.7
Co-600	62.0	7.7	20.4
Co-700	62.2	4.5	4.2
Co-800	145.7	1.4	4.1

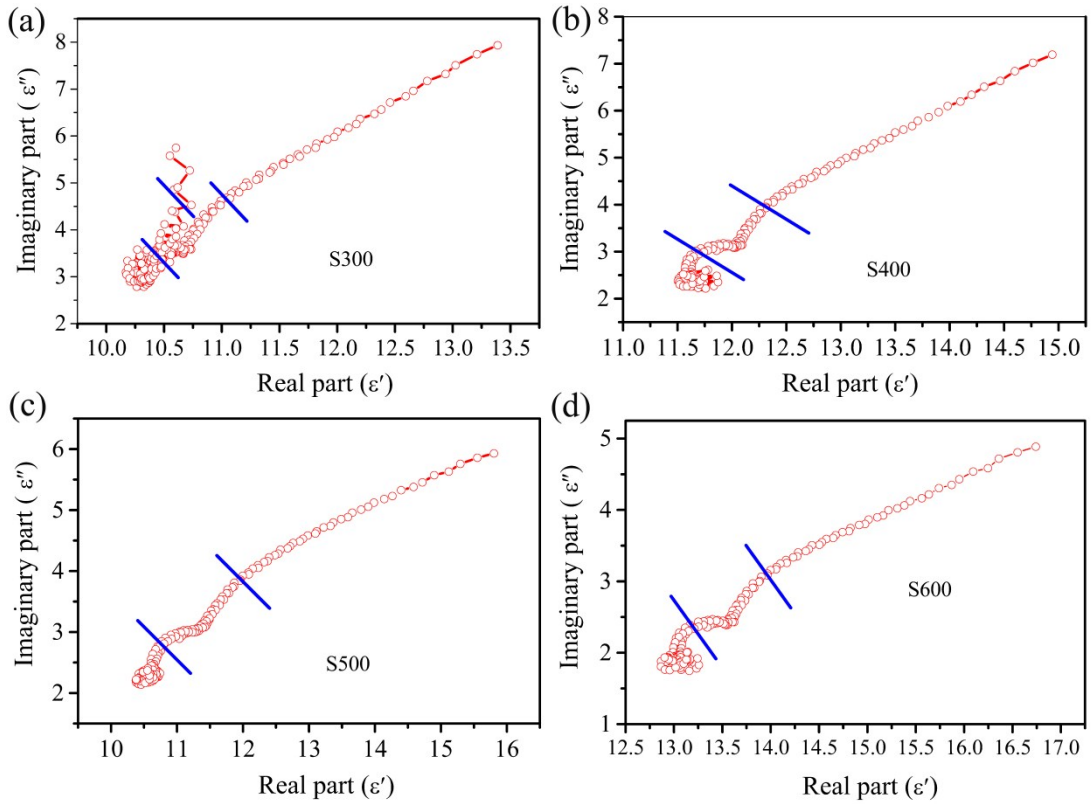

Figure S6 Cole– Cole plot of the Co_3O_4/paraffin composites: (a) S300, (b)S400, (c) S500 and (d) S600.

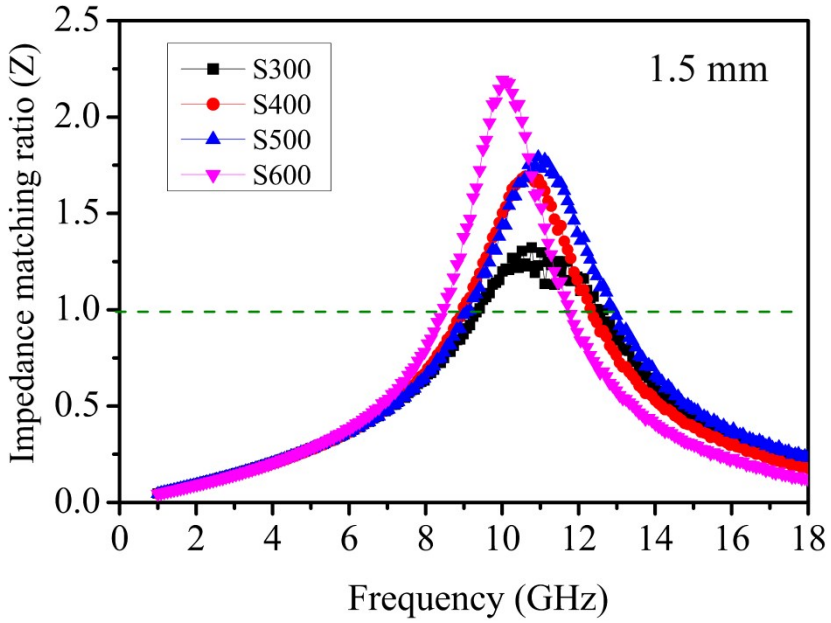

Figure S7 Modulus of impedance matching ratio Z ($Z = Z_{in}/Z_0$) of various porous Co_3O_4 samples with a thickness of 2.0 mm in the frequency range of 1−18 GHz.

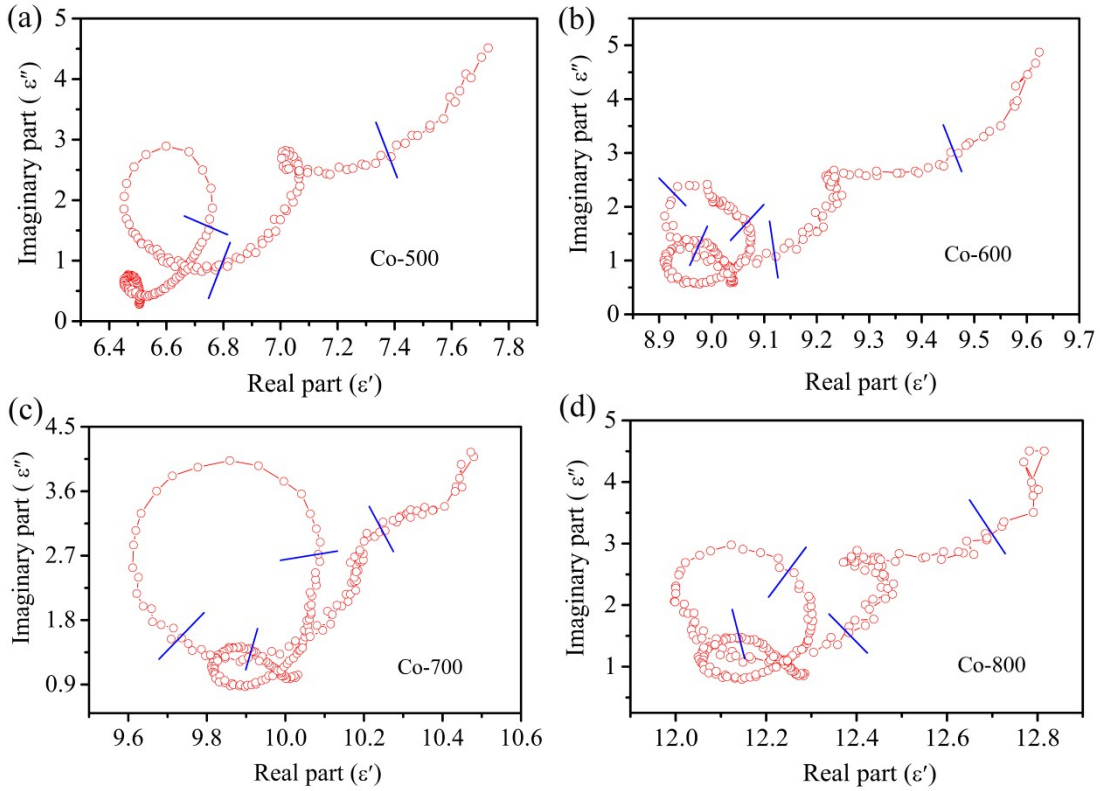

Figure S8 Cole– Cole plot of the Co/CoO paraffin-based composites: (a) Co-500, (b) Co-600, (c) Co-700 and (d) Co-800.

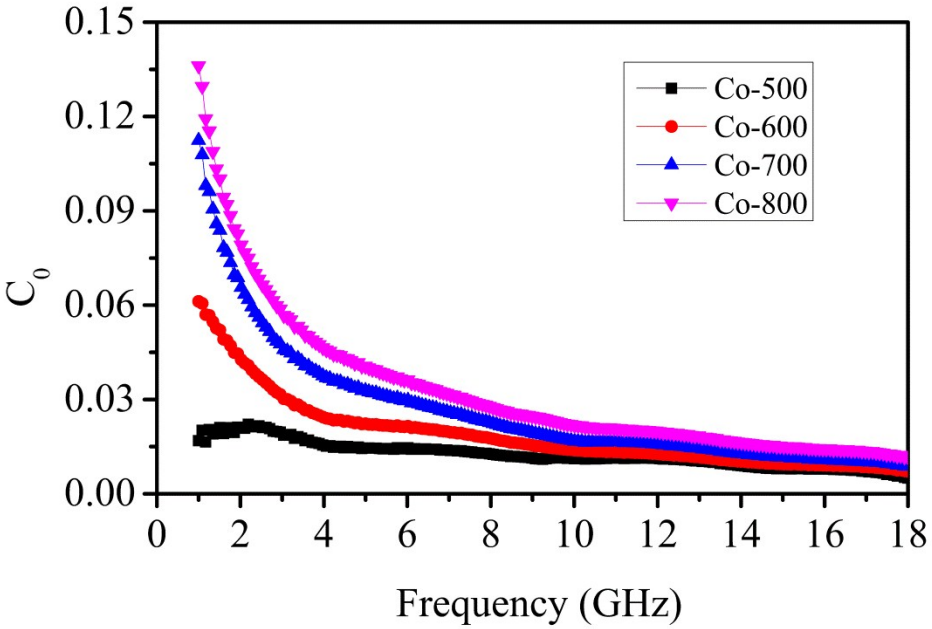

Figure S9 The value C_0 ($\mu''(\mu')^{-2} f^{-1}$) as a function of frequency for porous Co/CoO nanofibers-paraffin composite

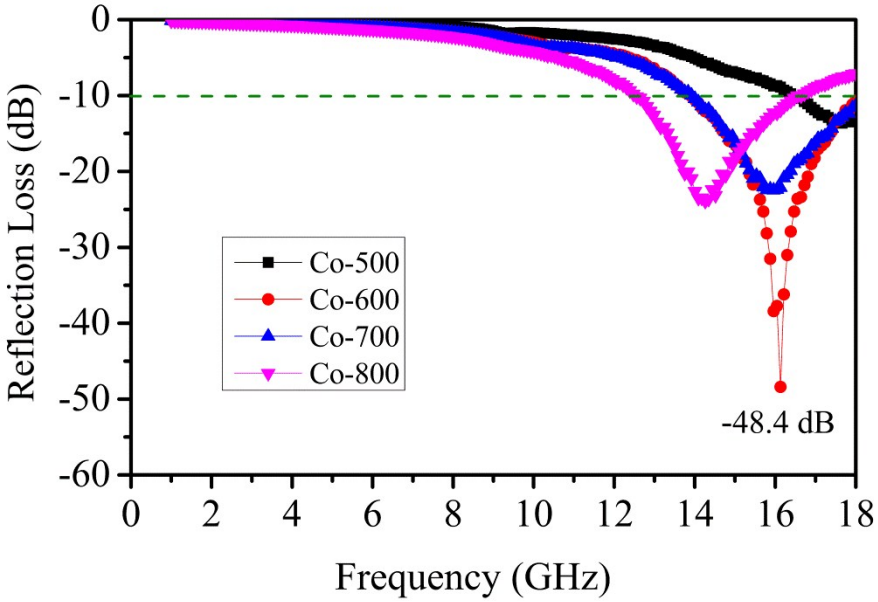

Figure S10 Reflection loss (RL) of various porous Co/CoO nanofibers with a thickness of 1.5 mm in the frequency range of 1−18 GHz.

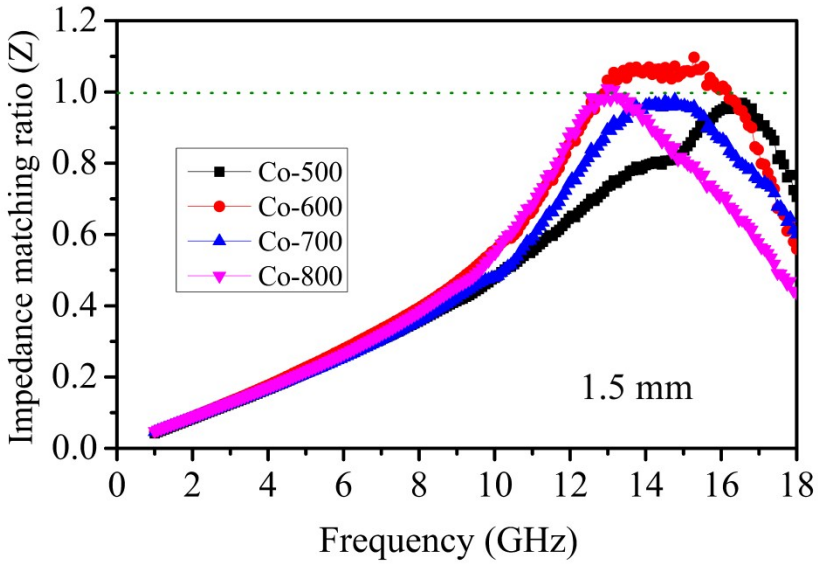

Figure S11 Modulus of impedance matching ratio Z ($Z = Z_{in}/Z_0$) of various porous Co/CoO nanofibers samples with a thickness of 1.5 mm in the frequency range of 1−18 GHz