Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Graphene Aerogel Composites Derived From Recycled Cigarette Filter for Electromagnetic Wave Absorption

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Supplementary Information:

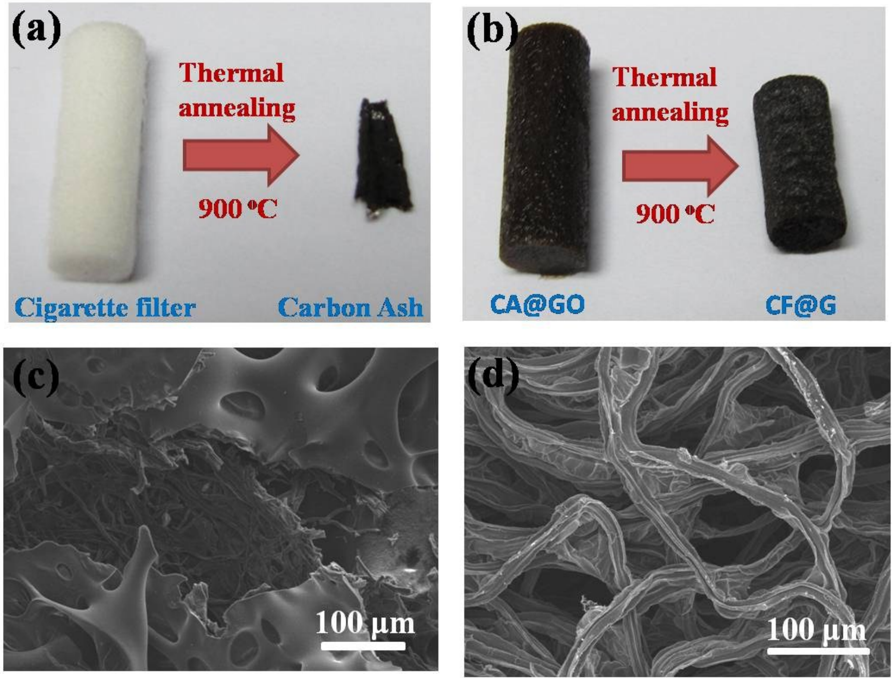

Figure S1. Characterization of carbon ash and CF@G aerogel derived from pure cigarette filter and CA@GO, respectively. a) Carbon ash derived from cigarette filter without GO coating. b) CF@G aerogel derived from GO coated cigarette filter. c) SEM image of carbon ash shows the interior structure. d) SEM image of CF@G aerogel shows the porous structure.

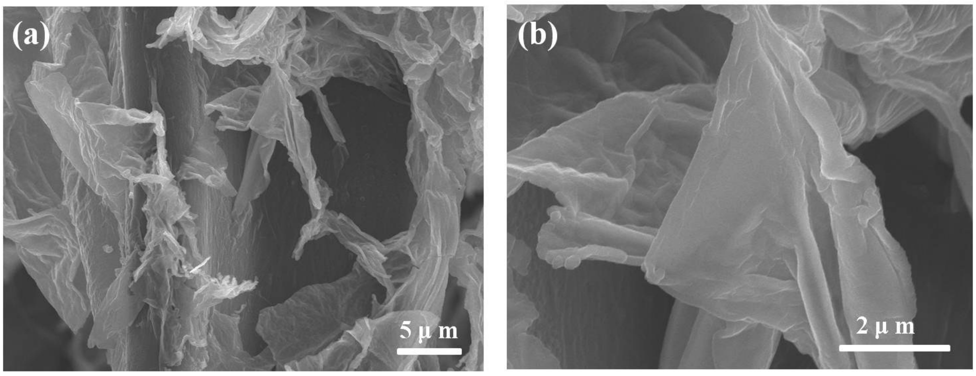

Figure S2. SEM images of CF@G@PPy aerogel. a) PPy coated graphene nanosheets adhere to the CF. b) The coated graphene nanosheets are thicker than bare nanosheets.

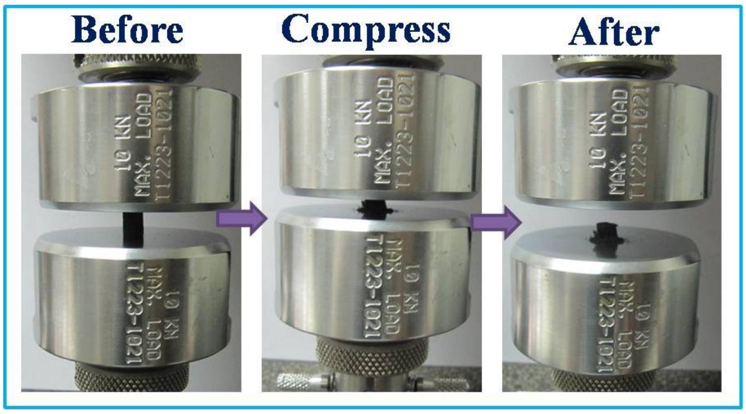

Fig. S3 Photos of mechanical test of CF@G and CF@G@PPy aerogels.

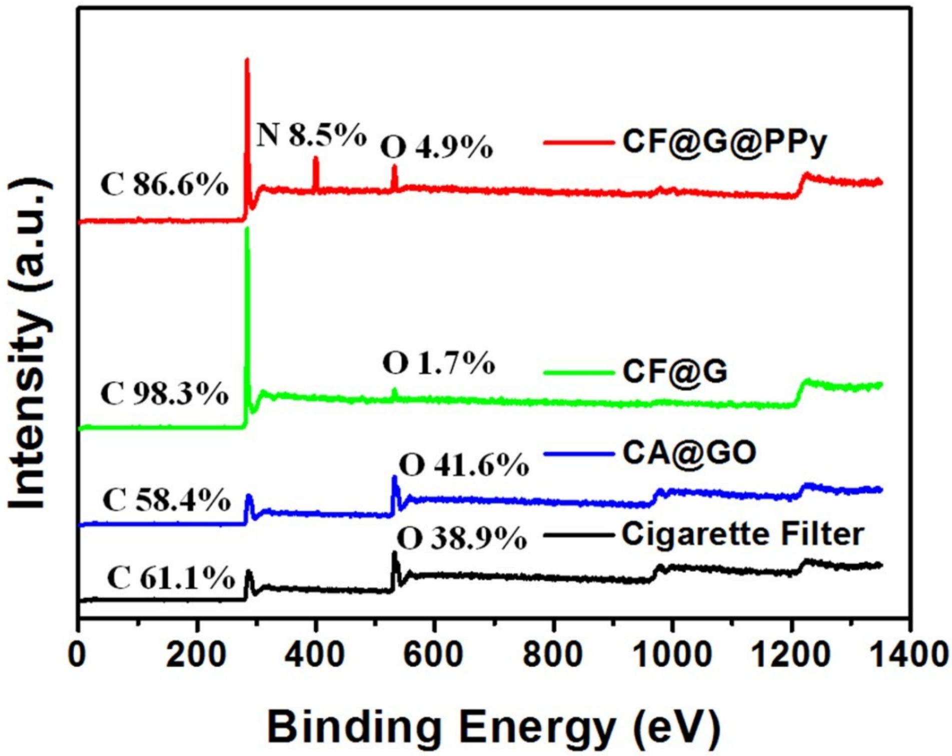

Figure S4. XPS spectrum of Cigarette Filter, CA@GO, CF@G and CF@G@PPy samples.

Table S1. Mechanical Strength of typical graphene based aerogel

Materials	**Density (mg cm^{-3})**	**Strain**	**Strength (kPa)**	**Ref.**
CF@G aerogel	7.6	~ 30%	70	This work
CF@G@PPy aerogel	8.8	~ 30%	90	This work
Graphene aerogel	3.0-9.7	90%	20	S1
Graphene aerogel	5.1	80%	18	S2
Graphene/MWCNT foam	5.6	50%	6.5	S3
Graphene foam	8	70%	0.075	S4
Graphene-GNR aerogel	6.8	80%	9	S5
N-doped Graphene aerogel	8.3	60%	60	S6

References

[s1] Hu, H.; Zhao, Z. B.; Wan, W. B.; Gogotsi, Y.; Qiu, J. S. Ultralight and Highly Compressible Graphene Aerogels. *Adv. Mater.* **2013**, *25*, 2219-2223.

[s2] Qiu, L.; Liu, J. Z.; Chang, S. L. Y.; Wu, Y. Z.; Li, D. Biomimetic Superelastic Graphene-Based Cellular Monoliths. *Nat. Commun*. **2012**, *3*, 1241.

[s3] Sun, H. Y.; Xu, Z.; Gao, C. Multifunctional, Ultra-Flyweight, Synergisitcally Assembled Carbon Aerogels. *Adv. Mater.* **2013**, *25*, 2554-2560.

[s4] Zhang, R. J.; Cao, Y. C.; Li, P. X.; Zang, X. B.; Sun, P. Z.; Wang, K. L.; Zhong, M. L.; Wei, J. Q.; Wu, D. H.; Kang, F. Y.; Zhu, H. W. Three-Dimensional Porous Graphene Sponges Assembled with the Combination of Surfactant and Freeze-drying. *Nano Res.* **2014**, *7*, 1477-1487.

[s5] Wang, C. H.; He, X. D.; Shang, Y. Y.; Peng, Q. Y.; Qin, Y. Y.; Shi, E. Z.; Yang, Y. B.; Wu, S. T.; Xu, W. J.; Du, S. Y.; Cao, A. Y.; Li, Y. B. Multifunctional Graphene Sheet-Nanoribbon Hybrid Aerogels. *J. Mater. Chem. A* **2014**, *2*, 14994-15000.

[s6] Wang, C. H.; Li, Y. B.; He, X. D.; Ding, Y. J.; Peng, Q. Y.; Zhao, W. Q.; Shi, E. Z.; Wu, S. T.; Cao, A. Y. Cotton-Derived Bulk and Fiber Aerogels Grafted with Nirtrogen-Doped Graphene. *Nanoscale* **2015**, *7*, 7550-7558.

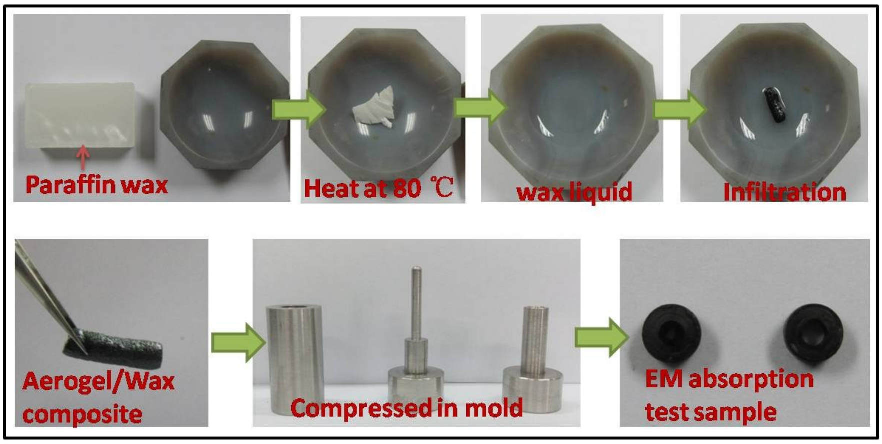

Figure S5. Fabrication process of paraffin infiltrated samples for EM absorption test.

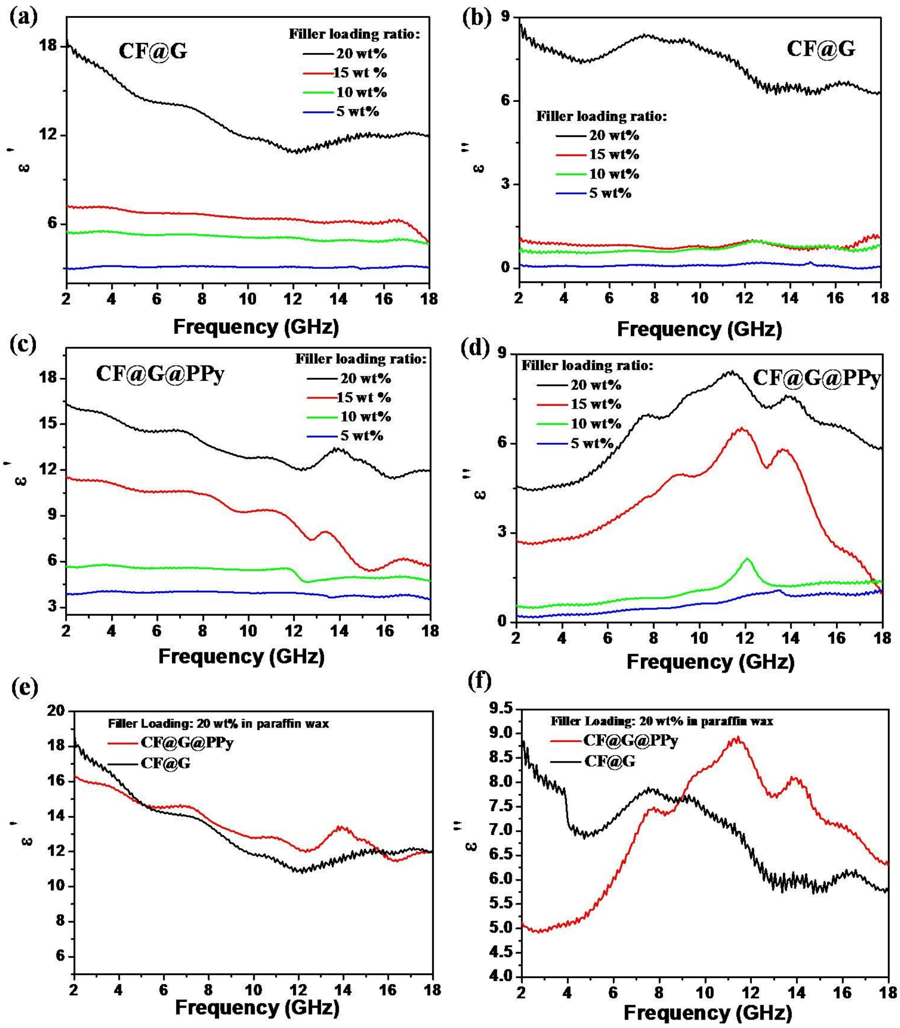

Figure S6. The real part permittivity (ε') and imaginary part permittivity (ε'') of CF@G and CF@G@ PPy. a, c) The real part permittivity (ε') of CF@G and CF@G@PPy, respectively. b, d) The imaginary part permittivity (ε'') of CF@G and CF@G@PPy, respectively. e, f) Comparison of ε' and ε'' between CF@G@PPy and CF@G aerogels with 20 wt% in paraffin wax.

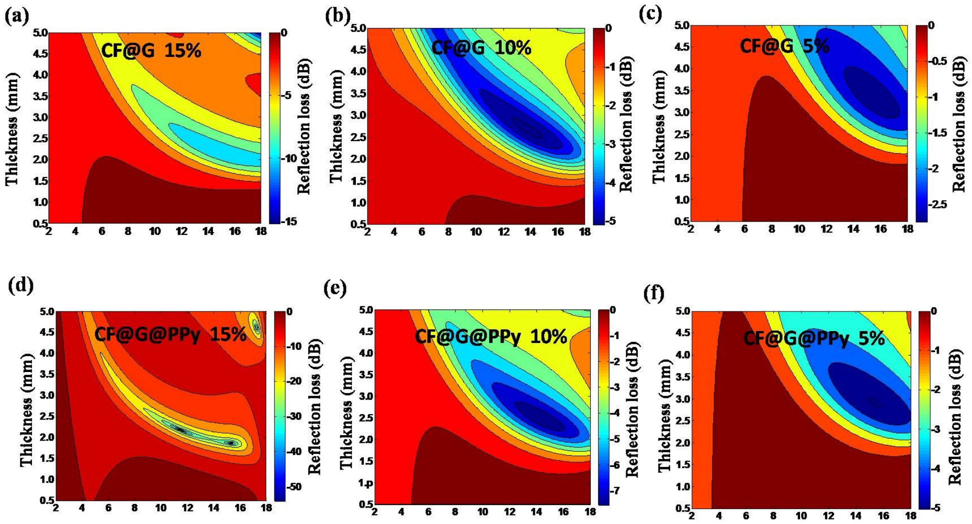

Figure S7. Contour maps of reflection loss values of CF@G and CF@G@PPy with different filler loadings in Wax.

Table S2 Typical graphene-based composite aerogels and PPy aerogel for EM wave absorption reported in recent literature

Filler	Optimum Frequency (GHz)	Optimum Thickness (mm)	RL_m(dB)	Frequnecy Range (<10dB) (GHz)	Ref.
aaaaCF@G	14.6	1.5	-30.53	12.7-16.8	*this work*
CF@G@PPy (20%)	7.9	2.5	-45.12	6.9-9.4	*this work*
CF@G@PPy(46.5%)	14.5	2	-34.2	11.9-16.2	*this work*
CF@G@PPy (70%)	17.9	4	-22.8	17.6-18	this work
GA@C	12.19	3.5	-43.5	9.36-16.83	*Ref.* 29
GA@Fe_3O_4	8.0	4	-27	6.5-10.3	*Ref.* 34
GA@Fe_2O_3	7.12	5	-33.5	6.0-9.2	*Ref.* 28
GA@ZnO	10.36	3	-25.95	8.0-12.68	*Ref.* 27
PPy Aerogel	17.0	2	-34	14.0-18.0	*Ref.* 20