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Supporting Information

Towards efficient microwave absorption: intrinsic heterostructure of fluorinated SWCNT

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Table S1. assignments of different components of the XPS C1 spectra.

component	assignment	2.4%F		6.8%F		15.5%F		31.4%F	
		position (eV)	concn (%)	position (eV)	concn (%)	position (eV)	concn (%)	Position (eV)	concn (%)
C (1)	C=C(sp^2)	284.5	67.6	284.5	48.4	284.4	34.3	284.4	12.4
C (2)	C–C(sp^3)	285.3	11.5	285.4	27.0	285.4	27.2	285.5	19.0
C (3)	C–O, C-CF	286.7	11.6	286.8	10.8	286.7	10.7	286.8	13.5
C (4)	C=O, CF-C-CF	288.5	4.6	288.3	7.7	288.3	15.1	288.4	18.3
C (5)	C–F	289.5	1.8	289.5	3.2	289.4	9.8	289.5	29.0
C (6)	CF_2	290.9	2.9	291.0	2.9	291.0	2.9	291.0	7.8
$S_{fluorinated}$: $S_{aromatic}$		**0.48**		**1.06**		**1.92**		**7.06**	

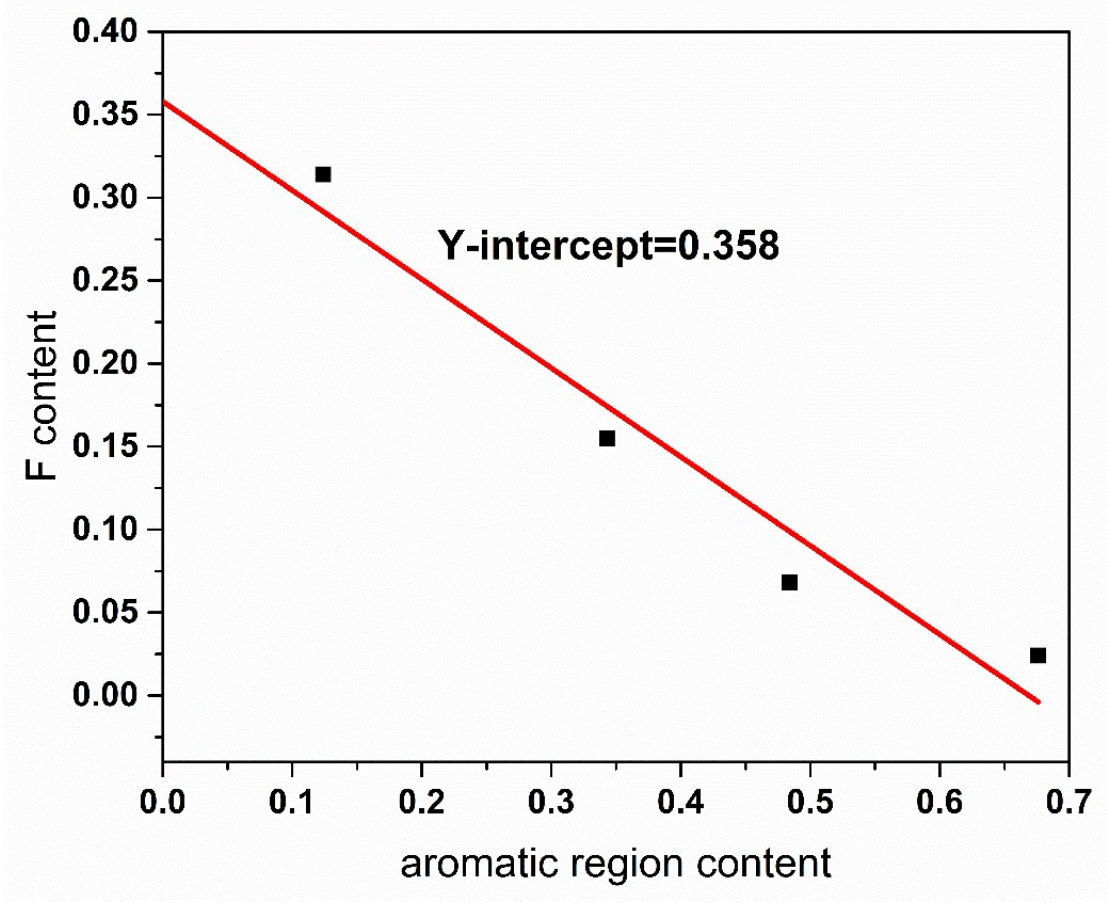

Fig. S1 plot of F content versus aromatic region content of F-SWCNT with various F content.

The F content in fluorinated domains is calculated by prolonging the trend line of plot of F content versus aromatic region content. The Y-intercept, 0.358, which represent the F content when there is no aromatic domains left, is the calculated F content in fluorinated domains.

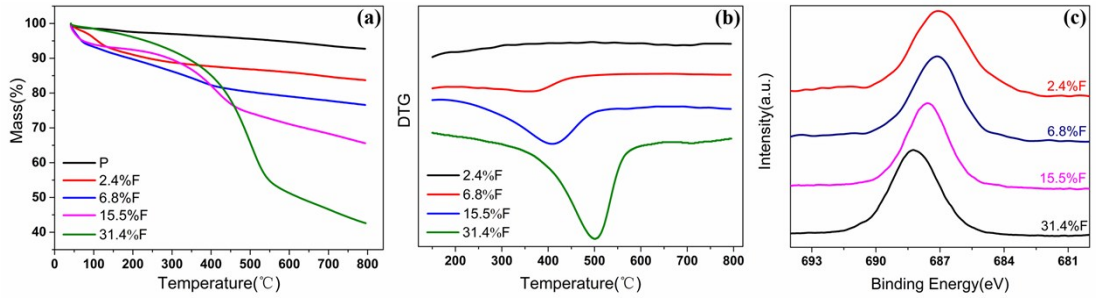

Fig. S2 (a)TGA and (b)DTG and (c)F 1s/XPS spectra curves of F-SWCNTs with various F-content.

TGA was carried out to analysis the nature of carbon-fluorine bonds. The weight loss in the range of 300-600°C is related to the drop of fluorine-containing groups. The result of TGA is in good accordance of that of XPS as regard to the fluorine content. Figure S1(b) is the DTA curves (the first derivative of TGA curves versus temperature) of F-SWCNT. The weight loss peaks shift to higher temperature with rising fluorination degrees. Similar phenomenon is observed in the XPS spectra of F 1s, where the binding energy also show an upshift tendency with increasing fluorine content. These shifts suggest that the C-F bonds in samples with higher fluorination degree are more stable, which are related to the shrinkage of aromatic regions. It has been reported that the hyperconjugation effects could occur between double-bond carbon atoms and adjacent carbon atom bonded with F atoms.[1-3] These hyperconjugation effects could weaken C-F covalence because it would to some extent leads to the delocalization of the σ electron involved in C-F covalent bond.[4] With decreasing aromatic regions, the number of double-bond carbon atoms that surround each C-F covalent bond diminish, resulting in less hyperconjugation effects and more stable C-F bonds. In this regard, the DTA and F 1s/XPS spectra can indirectly prove the co-existence of aromatic domains and fluorinated domains in our F-SWCNT.

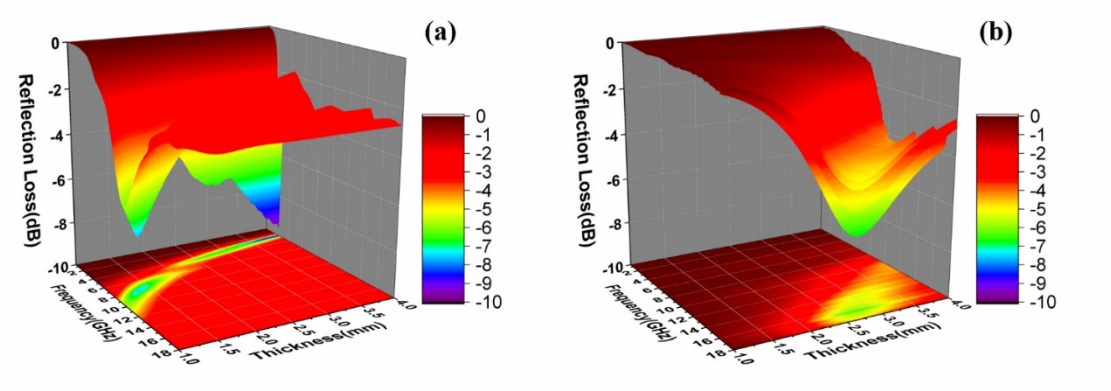

Fig. S3 3D RL plots of (a)P-SWCNTs and (b) 31.4%F-SWCNTs versus frequency ranging from 0.5 to 18GHz and thickness ranging from 1 to 4 mm.

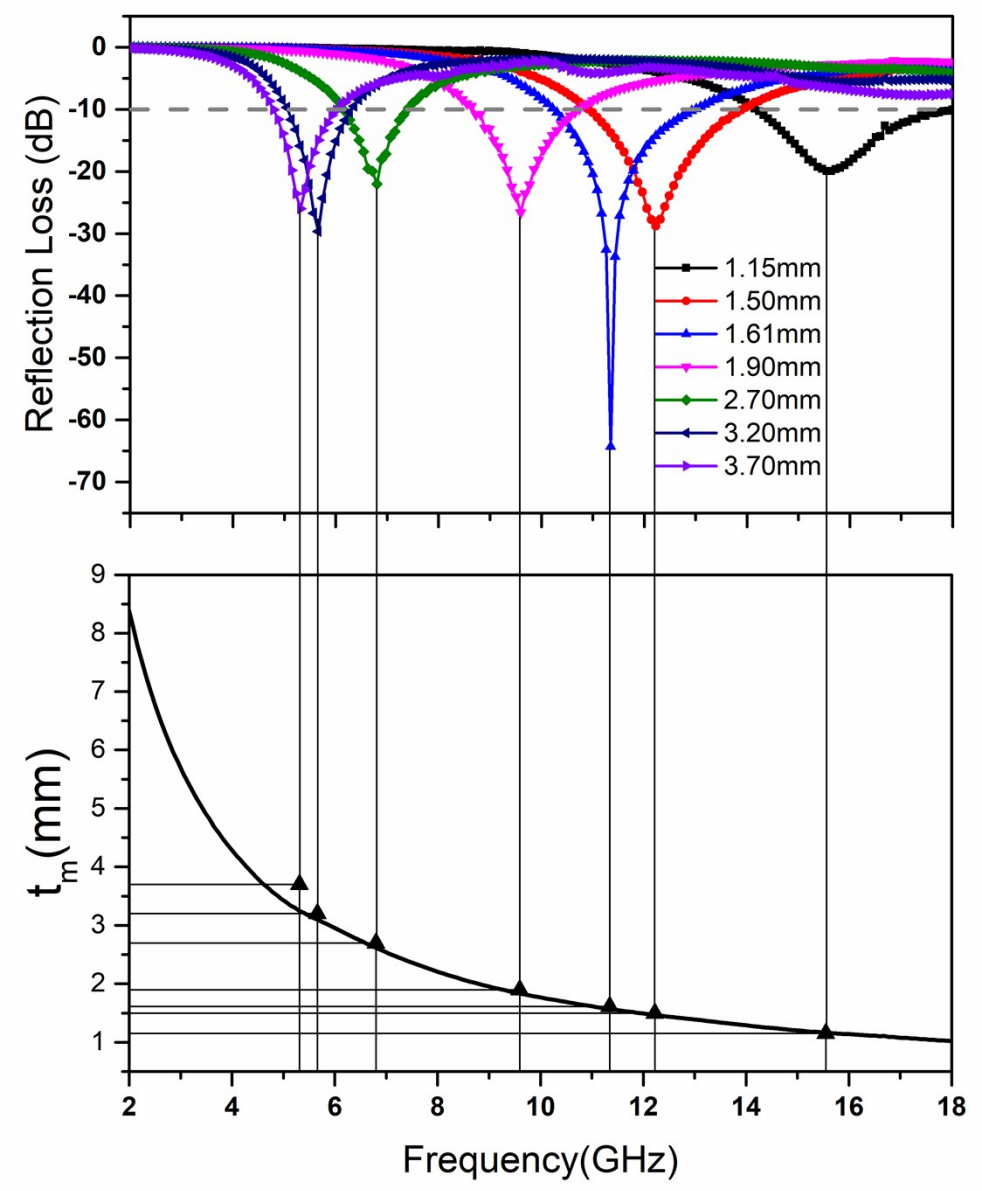

Fig. S4 Reflection loss curves and dependence of matching thickness versus matching frequency with n=1

Reference

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