Supporting Information

Oxidized multiwall carbon nanotubes/silicone foam composites with effective electromagnetic interference shielding and high gamma radiation stability

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1. Oxidation of MWCNTs

4 g of MWCNTs were dispersed in 80 mL of the mixture of nitric acid and sulfuric acid in ratio 1:1 in a 250 mL round bottom flask with a condenser and the dispersion was refluxed while stirring for 5 h at 110 °C.

The o-MWCNTs were purified as follow: the resulting dispersion was diluted in 600 mL water, stirred for 2 h and left standing overnight. Then the dispersion was filtered and the resulting solid was washed up to neutral pH. After the purification process, o-MWCNTs were dried in the oven at 100 °C overnight.

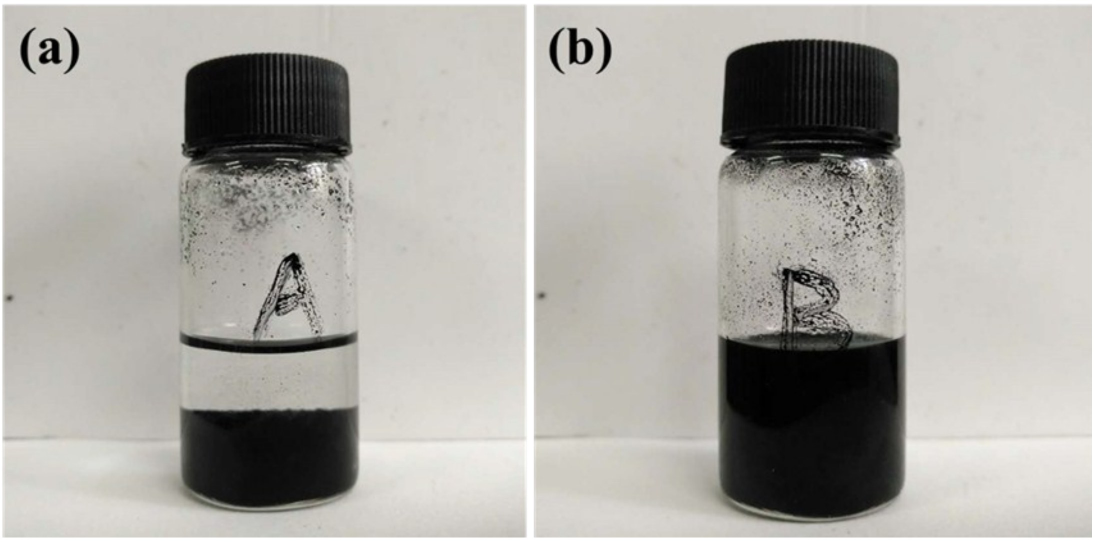


Figure S1 Optical images of the dispersion of: (a) 10 wt% MWCNTs/THF; (b) 10 wt% o-MWCNTs/THF. The samples were stirred for 1 h and left standing for 1 h.

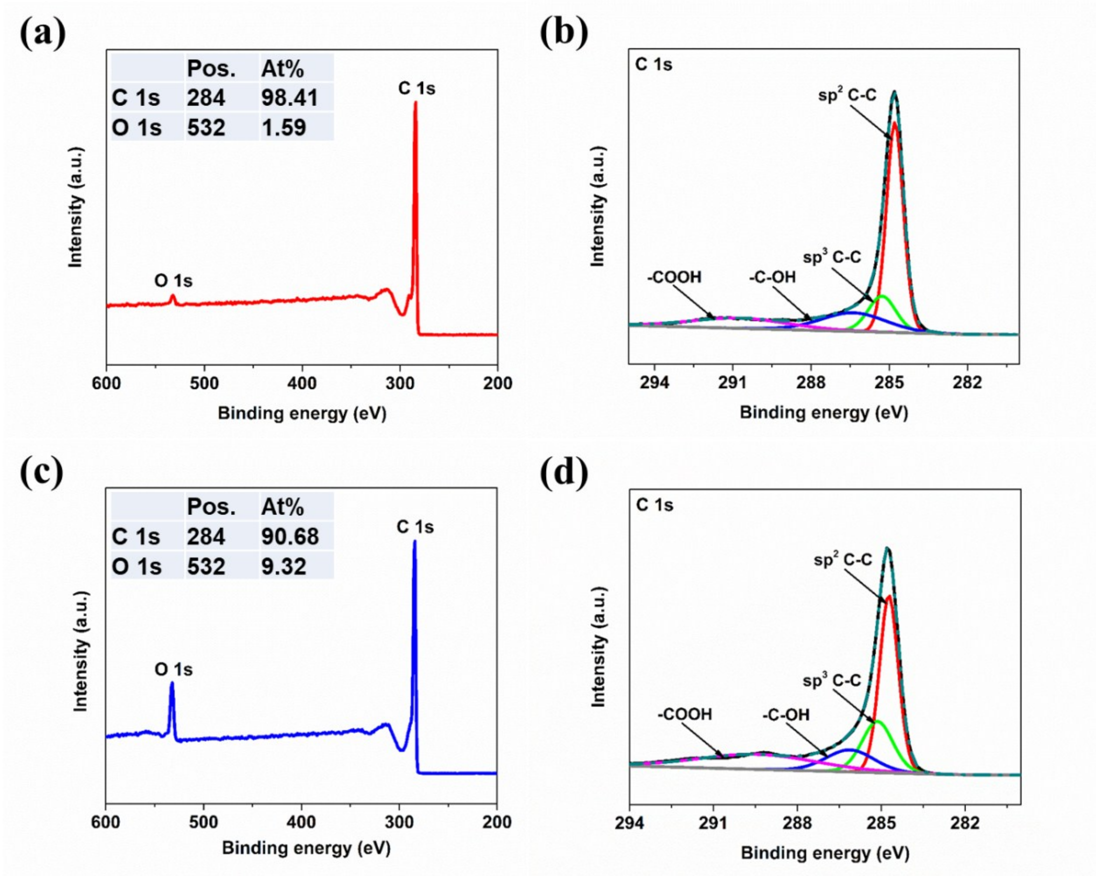


Figure S2 XPS spectra of (a) MWCNTs; (b) C 1s peaks of MWCNTs; (c) o-MWCNTs; (d) C 1s peaks of o-MWCNTs

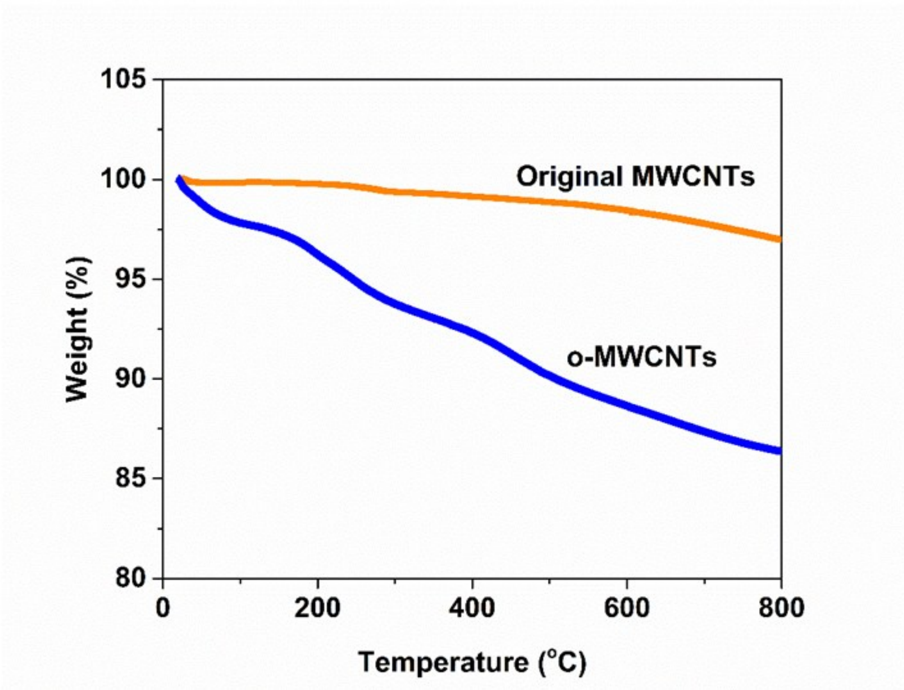


Figure S3 TG curves of original MWCNTs and o-MWCNTs.

2. Shielding Mechanism

The reflection (R), transmission (T) and absorption (A) coefficients were calculated by Eq. (1) - (3) based on the S parameters.

$$R + A + T = 1 \quad (1)$$

$$R = |S_{11}|^2 \quad (2)$$

$$T = |S_{12}|^2 \quad (3)$$

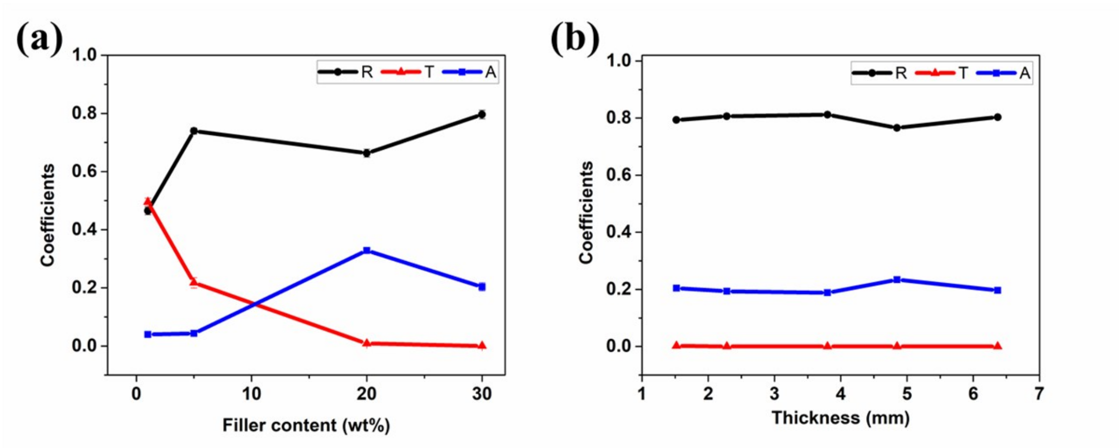


Figure S4 The R, T and A coefficients as a function of (a) filler content and (b) thickness (30 wt% o-MWCNT) at 12.4 GHz.

3. Dielectric Characteristics

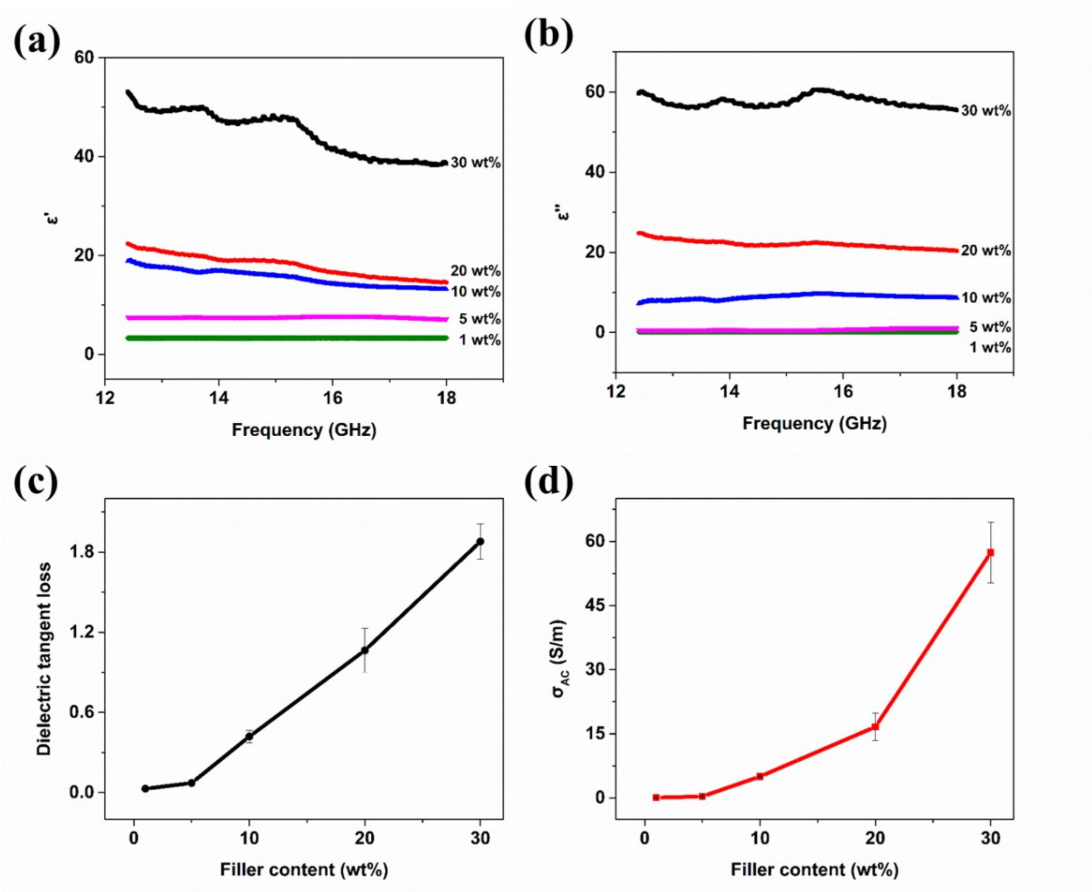
In electromagnetic field, it is more reasonable to express the parameters permittivity in a complex number with a real part (ε') and an imaginary part (ε") as follows:

$$\varepsilon = \varepsilon' - i\varepsilon'' \quad (4)$$

where ε' represents the storage ability of electric and ε" symbolizes the dissipated electric energy.[1] The dielectric tangent loss is defined as the ratio of the imaginary part to the real part ($\tan\delta = \varepsilon''/\varepsilon'$) to quantify the coupling ability of dielectric materials with the electromagnetic waves. Alternating current (AC) conductivity (σ_{AC}) of silicone composites can be calculated from the imaginary part of complex permittivity using the following formula:

$$\sigma_{AC}(S/m) = 2\pi f \varepsilon_0 \varepsilon'' \quad (5)$$

Where f is the frequency and ε_0 represents the permittivity of free space (



$\varepsilon_0 = 8.854 \times 10^{-12}\ F/m$). [2]

Figure S5 (a) Real part and (b) imaginary part of complex permittivity of o-MWCNT/silicone foam composites as a function of frequency with various o-MWCNT content; (c) the corresponding dielectric tangent loss and (d) AC conductivity at 12.4 GHz of o-MWCNT/silicone foam composites as a function of o-MWCNT content.

REFERENCES

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2 M. H. Al-Saleh, W. H. Saadeh and U. Sundararaj, *Carbon*, 2013, **60**, 146-156.