Electronic Supplementary Material (ESI) for Nanoscale.


# Supporting Information

# Two-dimensional Nanosheets of $MoS_2$: A Promising Material With High Dielectric Properties and Microwave Absorption Performances

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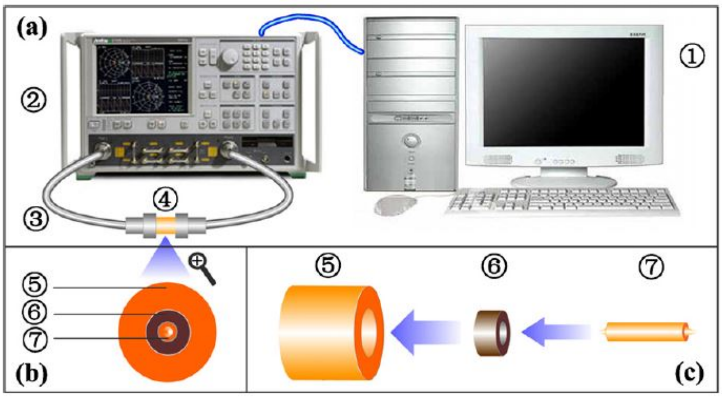


**Figure S1.** (a) Test apparatus: (1) computer, (2) vector network analyzer, (3) coaxial cable, (4) test chamber; (b) cross section of the test chamber: (5) out conductor, (6) test sample, (7) inner conductor; and (c) the detailed illustration in the test chamber.[1]

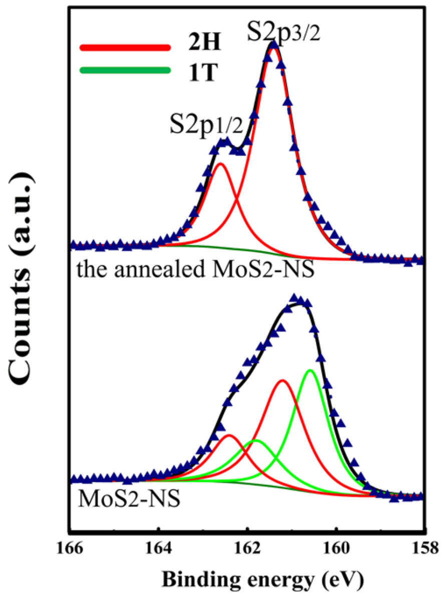


**Figure S2.** XPS spectra showing S 2s, and S 2p peak regions of $MoS_2$-NS and the annealed $MoS_2$-NS samples

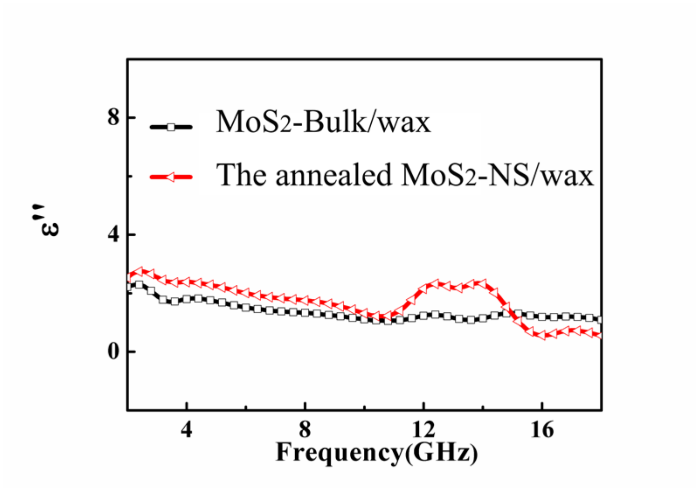


**Figure S3.** The ε" of MoS2-Bulk/wax and annealed MoS2-NS/wax

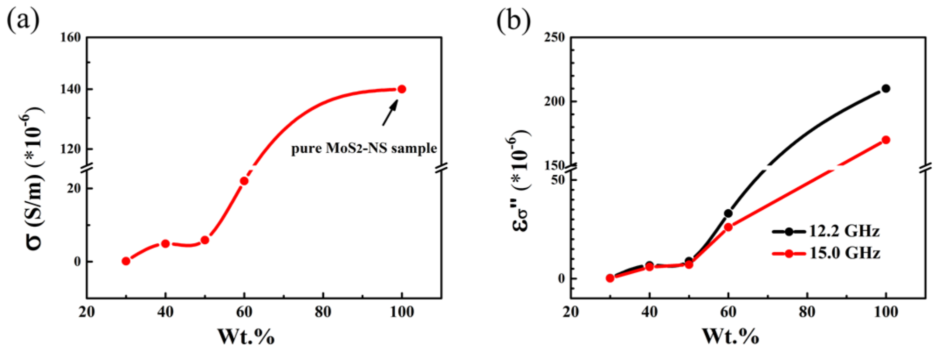


**Figure S4.** (a) The $\sigma$ of the MoS2-NS/wax at different loadings and pure MoS2-NS sample

(b) The contribution of $\sigma$ to the ε"

(The contribution of the σ to the ε" is calculated according to the Debye theory equation (2). Where the peak frequencies (i.e. 15.0 GHz and 12.2 GHz) of relaxations in Fig 4 (b) and (d) are chosen for the calculation. Take the 60 Wt.% at the frequency 12.2 GHz as an example,

$$\varepsilon''_{60\%} = \frac{\sigma_{60\%}}{\omega\varepsilon_0} = \frac{\sigma_{60\%}}{2\pi f \varepsilon_0}$$

$= (2.2*10^{-5}) / (2*3.14*12.2*10^{9}*8.85*10^{-12})$

$= 3.2*10^{-5}$ )

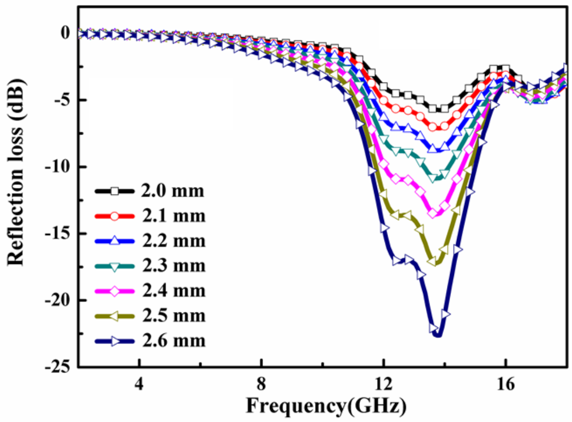


**Figure S5.** RL of the annealed MoS2-NS/wax with 60 Wt.% at different thicknesses

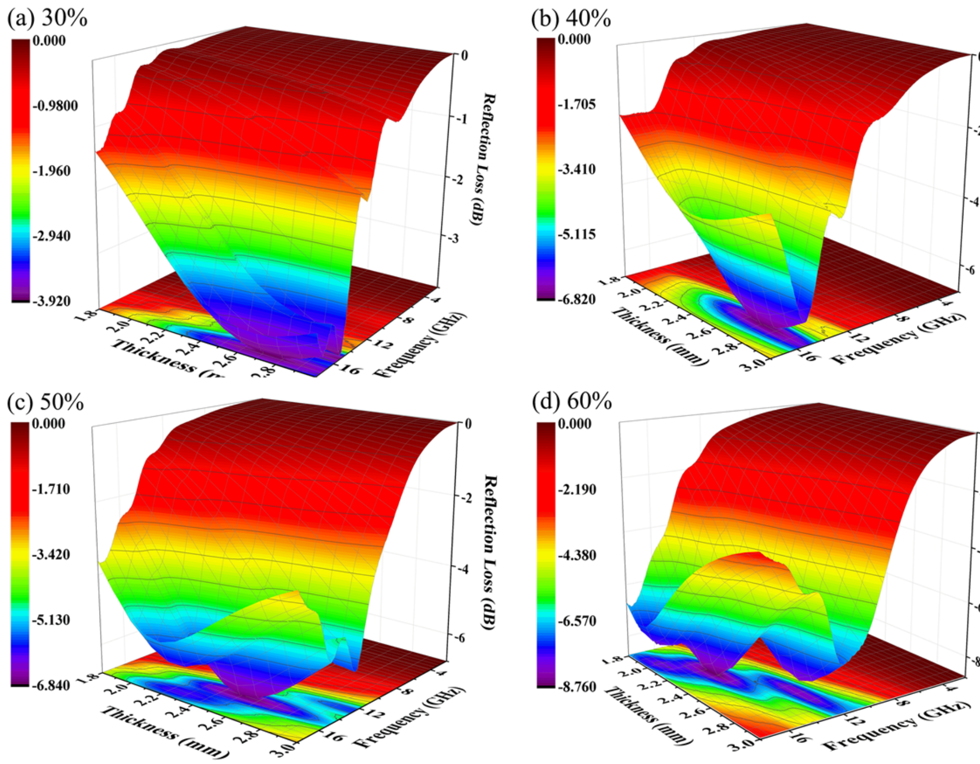


**Figure S6.** 3D plot of the RL versus the frequency and thickness of MoS2-Bulk/wax at different loadings

**Table S1.** **Microwave Absorption Performance of Representative carbon-based composites**

| Samples | percentage | Maximum RL value (dB) | d (mm) (RL > 10 dB) | Frequency range (GHz) (RL > 10 dB) | Effective bandwidth (RL > 10 dB) | Frequency range (GHz) (RL > 5 dB) | Effective bandwidth (RL>5 dB) | ref |
|---|---|---|---|---|---|---|---|---|
| Single-Walled Carbon Nanotubes/ polyurethane | 5% | 22 | 2 | 7.6-9.3 | 1.7 | - | - | 2 |
| Multi-walled carbon nanotubes/polymer | 8% | 24.27 | 1 | 13.2-18 | 4.8 | - | - | 3 |
| Aligned Carbon-Nanotube Films/PANI | 30% | 41.14 | 2 | - | 4.43 | - | - | 4 |
| Porous carbon fibers/epoxy | 6% | 32 | 2.3 | - | - | 8.2-12.4 | 4.2 | 5 |
| Twin carbon nanocoils/paraffin | 15% | 36.09 | 2 | - | ~10 | - | - | 6 |
| r-GO/ethylene oxide | 2.6% | 38 | 1.8 | 14-18 | 4 | - | - | 7 |
| RGO–Ni/wax | 60% | 18 | 5 | 3-4;11.5-13.5 | 3 | - | - | 8 |
| $MoS_2$-NS/wax | 60% | 38.42 | 2.4 | 9.6-13.76 | 4.1 | - | - | This work |

## References


1 W. L. Song, M. S. Cao, B. Wen, Z. L. Hou, J. Cheng, and J. Yuan, *Mater.Res.Bull.*, 2012, 47, 1747

2 Z. F. Liu, G. Bai, Y .Huang, F. F .Li, Y. F. Ma,T. Y .Guo, X. B. He, X. Lin, H. J. Gao, Y. S. Che, *J. Phys. Chem. C*., 2007, 111,13696.

3 Z. J .Fan , G. H. Luo, Z. F. Zhang, L. Zhou, , F. Wei, Mater. *Sci.Eng. B.,* 2006, 132, 85.

4 H.Sun , R.C.Che ,X.You , Y.S. Jiang , Z.B. Yang , J. Deng , L.B Qiu ,and H.S. Peng, *Adv. Mater*. 2014, 26, 8120.

5 G. Li, T.S.Xie, S.L. Yang, J.H. Jin, and J.M. Jiang, *J. Phys. Chem. C* ,2012, 116, 9196.

6 N.J Tang,W. Zhong, C.T. Au,Y. Yang, M,G Han,K.J Lin and Y. W Du, *J. Phys. Chem. C*, 2008, 112, 19316.

7 X. Bai, Y. H. Zhai and Y. Zhang, *J. Phys. Chem. C*, 2011, 115, 11673.

8 T. T. Chen, F. Deng, J. Zhu, C. F. Chen, G. B. Sun, S. L. Ma and X. J. Yang, *J. Mater. Chem*., 2012, 22, 15190.