Supporting Information

Two-dimensional Nanosheets of MoS$_2$: A Promising Material With High Dielectric Properties and Microwave Absorption Performances

Ming-Qiang Ning, ‡ Ming-Ming Lu, ‡ Jing-Bo Li, * Zhuo Chen, * Yan-Kun Dou, Fida Rehman, Mao-Sheng Cao, * Hai-Bo Jin*

School of Material Science and Engineering, Beijing Institute of Technology, Beijing 100081, China.

Contents

S1. Test apparatus

S2. XPS spectra showing S 2s, and S 2p peak regions of MoS$_2$-NS and the annealed MoS$_2$-NS samples

S3. The $\varepsilon''$ of MoS$_2$-NS/wax and the annealed MoS$_2$-NS/wax.

S4. (a) The $\sigma$ of the MoS$_2$-NS/wax at different loadings and pure MoS$_2$-NS sample
(b) The contribution of $\sigma$ to the $\varepsilon''$

S5. RL of the annealed MoS$_2$-NS/wax with 60 Wt.% loading at different thicknesses.

S6. 3D plot of the RL versus the frequency and thickness of MoS$_2$-Bulk/wax at different loadings.

Table S1. Microwave absorption performance of representative carbon-based composites.
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 MoS₂-NS and the annealed MoS₂-NS samples
Figure S3. The $\varepsilon''$ of MoS$_2$-Bulk/wax and annealed MoS$_2$-NS/wax

Figure S4. (a) The $\sigma$ of the MoS$_2$-NS/wax at different loadings and pure MoS$_2$-NS sample

(b) The contribution of $\sigma$ to the $\varepsilon''$

(The contribution of the $\sigma$ to the $\varepsilon''$ 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,

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

$$= \frac{2.2*10^{-5}}{2*3.14*12.2*10^9*8.85*10^{-12}}$$

$$= 3.2*10^{-5}$$)
**Figure S5.** RL of the annealed MoS$_2$-NS/wax with 60 Wt.% at different thicknesses

**Figure S6.** 3D plot of the RL versus the frequency and thickness of MoS$_2$-Bulk/wax at different loadings
<table>
<thead>
<tr>
<th>Samples</th>
<th>percentage</th>
<th>Maximum RL value (dB)</th>
<th>d (mm)</th>
<th>Frequency range (GHz) (RL &gt; 10 dB)</th>
<th>Effective bandwidth (RL &gt; 10 dB)</th>
<th>Frequency range (GHz) (RL &gt; 5 dB)</th>
<th>Effective bandwidth (RL &gt; 5 dB)</th>
<th>ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Walled Carbon Nanotubes/ polyurethane</td>
<td>5%</td>
<td>22</td>
<td>2</td>
<td>7.6-9.3</td>
<td>1.7</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Multi-walled carbon nanotubes/polymer</td>
<td>8%</td>
<td>24.27</td>
<td>1</td>
<td>13.2-18</td>
<td>4.8</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Aligned Carbon-Nanotube Films/PANI</td>
<td>30%</td>
<td>41.14</td>
<td>2</td>
<td>-</td>
<td>4.43</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Porous carbon fibers/epoxy</td>
<td>6%</td>
<td>32</td>
<td>2.3</td>
<td>-</td>
<td>-</td>
<td>8.2-12.4</td>
<td>4.2</td>
<td>5</td>
</tr>
<tr>
<td>Twin carbon nanocoils/paraffin</td>
<td>15%</td>
<td>36.09</td>
<td>2</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>r-GO/ethylene oxide</td>
<td>2.6%</td>
<td>38</td>
<td>1.8</td>
<td>14-18</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>RGO-Ni/wax</td>
<td>60%</td>
<td>18</td>
<td>5</td>
<td>3-4.11.5-13.5</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>MoS&lt;sub&gt;2&lt;/sub&gt;-NS/wax</td>
<td>60%</td>
<td>38.42</td>
<td>2.4</td>
<td>9.6-13.76</td>
<td>4.1</td>
<td>-</td>
<td>-</td>
<td>This work</td>
</tr>
</tbody>
</table>

References