Electronic Supplementary Information

Formation of monolayer and few-layer hexagonal boron nitride nanosheets via surface segregation

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Thickness estimation

<table>
<thead>
<tr>
<th>Fe (LMM) transition</th>
<th>Substrate (sputtered for 0.4 min)</th>
<th>Buffer layer</th>
<th>Monolayer stack</th>
<th>Bilayer stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak-to-peak magnitude</td>
<td>10695</td>
<td>7237</td>
<td>4871</td>
<td>3441</td>
</tr>
<tr>
<td>Thickness</td>
<td>0.31 nm</td>
<td>0.65 nm</td>
<td>0.91 nm</td>
<td></td>
</tr>
</tbody>
</table>

To estimate the thickness of h-BN films, we used Fe (LMM) Auger transition with the electron inelastic mean free path of ~1.2 nm for iron at ~703 eV based on inelastic attenuation model of the following expression. By considering the carbon contamination, we used the peak-to-peak magnitude of Fe (LMM) transition from the AES spectra after sputtered for 0.4 min as the $I_{sub, pure}$. However, we used the peak-to-peak magnitude of Fe (LMM) transition from the AES spectra without sputtering as $I_{sub}$ because argon ion sputtering can damage the structure of h-BN and the buffer layer, and the carbon contamination at the buffer layer and h-BN regions is much less than at the bare substrate surface.

$$I_{sub} = I_{sub, pure} \exp\left[-\frac{nd_0}{\lambda \sin(\theta)}\right]$$

where $I_{sub}$ is the peak-to-peak magnitude of the Fe (LMM) transition prior to sputtering by ion-gun sputtering, $I_{sub, pure}$ is the peak-to-peak magnitude of the Fe (LMM) peak after removing most of the carbon contamination (i.e., 0.4 min sputtering time), $n$ is the number of h-BN, $d_0$ is the theoretical thickness of single h-BN sheet (~3.4 Å), $\theta$ is the electron take-off angle (42° for the present Auger instrument), and $\lambda$ is the inelastic mean free path (IMFP) of the Auger electrons for iron.
Figure S1. Typical SEM images of h-BN nanosheets synthesized by surface segregation from Fe-Cr-Ni alloy doped with boron and nitrogen.
Figure S2. AES spectra show elemental evolution as a function of sputtering time, acquired at (a)-(b) substrate region, (c)-(d) B-N buffer layer region, (e)-(f) monolayer h-BN region, and (g)-(h) bilayer h-BN region of the sample in Figure S3.

Figure S3. SEM images of h-BN flakes acquired before and after sputtered for different times. The black, red, blue, and green spots represent the substrate, B-N buffer layer, monolayer h-BN, and bilayer h-BN, respectively.
Figure S4. Atomic concentration of h-BN sample after sputtered for 1.9 min.