Supplemental Information

Layered MoS$_2$-graphene composites for biosensor applications with sensitive electrochemical performance

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Fig. S1 FT-IR spectra of (a) MoS$_2$, (b) graphene, (c) layered MoS$_2$-graphene film, and (d) layered Mb/MoS$_2$-graphene/Nafion composite film.

Fig. S2 UV-vis spectroscopy of (a) dry Mb film, and (b) dry layered Mb/MoS$_2$-graphene/Nafion film in pH 7.0 buffers.

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Fig. S3 The influence of the scan cycle numbers on the CV reduction peak current $I_{pc}$ for the layered Mb/MoS$_2$-graphene/Nafion films at a scan rate of 0.1 V s$^{-1}$ in pH 7.0 buffers.

Fig. S4 CVs of layered Mb/MoS$_2$-graphene/Nafion films in pH 7.0 buffers with different scan rates (a to h: 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 V s$^{-1}$). Insert is the relationship of anodic and cathodic peak currents versus scan rate.

Fig. S5 Influence of scan rate on catalytic efficiency, $I_i/I_o$, for layered Mb/MoS$_2$-graphene/Nafion film in 8 mL pH 7.0 buffers, where $I_o$ is the CV reduction peak current in buffer without oxygen and $I_i$ is the CV reduction peak current with 40 mL of air injected.
Fig. S6: Plot A: Amperometric response of (a) layered MoS$\text{2}$-graphene/Nafion film, and (b) layered Mb/MoS$\text{2}$-graphene/Nafion film at -0.1 V in pH 7.0 buffer solution with 10 µM H$_2$O$_2$ injected every 40 s. Plot B shows the calibration curve of amperometric currents and the concentrations of H$_2$O$_2$.

S7: RSD was calculated as following:

$$RSD = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \bar{X})^2}{n - 1}} \times 100\%$$

$\bar{X} = 0.58, 0.60, 0.61, 0.59, 0.61 \mu A$

$X_i = 0.58, 0.60, 0.61, 0.59, 0.61 \mu A$

Table S1: The electrochemical parameters for different Mb-films on GCE

<table>
<thead>
<tr>
<th>Film</th>
<th>$\Delta E_p$/mV</th>
<th>$I_{pc}$/μA</th>
<th>$E^0$/V vs SCE</th>
<th>$I^*$/mol cm$^{-2}$</th>
<th>$I^*/I^%$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mb/graphene/Nafion</td>
<td>61</td>
<td>0.70</td>
<td>-0.37</td>
<td>5.09×10$^{-11}$</td>
<td>1.29%</td>
</tr>
<tr>
<td>Mb/MoS$_2$/Nafion</td>
<td>60</td>
<td>0.79</td>
<td>-0.37</td>
<td>6.84×10$^{-11}$</td>
<td>1.73%</td>
</tr>
<tr>
<td>Layered Mb/MoS$_2$-graphene/Nafion</td>
<td>52</td>
<td>1.06</td>
<td>-0.38</td>
<td>9.00×10$^{-11}$</td>
<td>2.27%</td>
</tr>
</tbody>
</table>

$E^0$: the formal potential estimated as the midpoint of reduction and oxidation peak potentials; $\Delta E_p = E_{pa} - E_{pc}$: the separation between the anodic and the cathodic peak potentials; $I_{pc}$: the cathodic peak current; $I^*$: the surface concentration of electroactive Mb in different Mb-film. These data were estimated by CVs in pH 7.0 buffers at a scan rate of 0.2 V s$^{-1}$. 