

Supplementary Materials

Exciton-dominant Photoluminescence of MoS₂ by Functionalized Substrate

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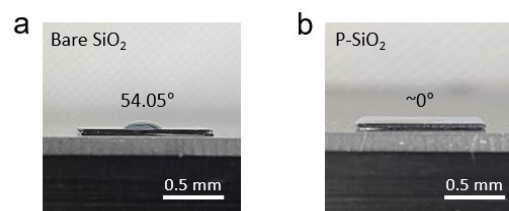


Fig. S1 The water contact angle on different treated SiO₂ substrate. **(a)** the water contact angle on the bare SiO₂ without any treatment was 54.05°. **(b)** the water contact angle on the plasma-treated SiO₂ with plasma treatment for 1 min was about 0°.

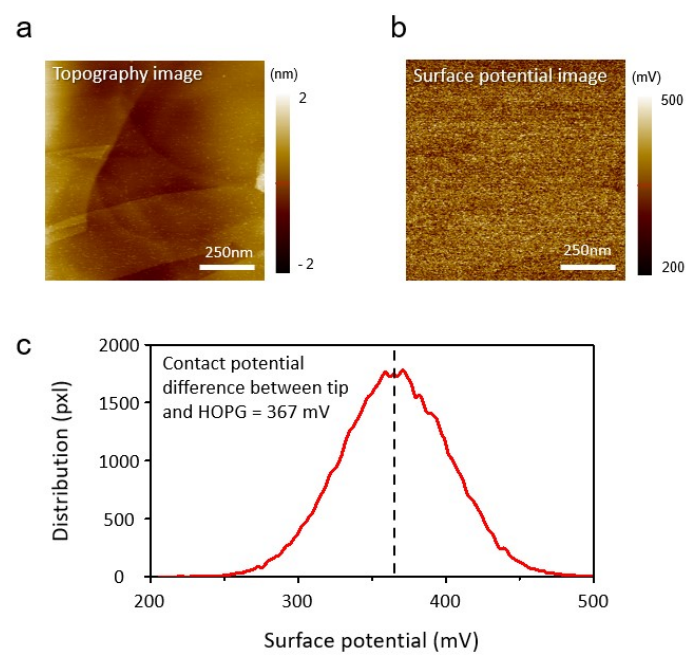
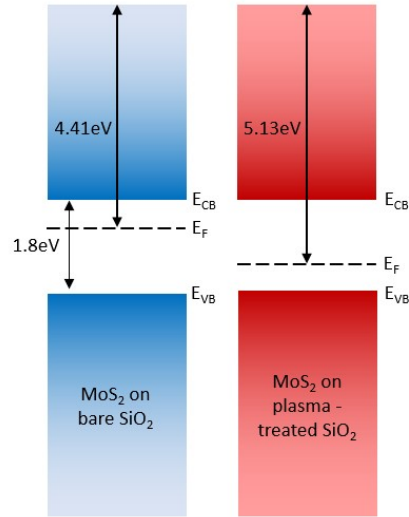


Fig. S2 The topography image of HOPG and (b) corresponding surface potential image (c) The surface potential distribution graph of figure S2 (b)



$$\text{Potential between sample and tip} = (\phi_{\text{tip}} - \phi_{\text{sample}})/e$$

$$\text{Potential between MoS}_2 \text{ and tip} = (\phi_{\text{tip}} - \phi_{\text{MoS}_2})/e$$

$$\phi_{\text{MoS}_2} = \phi_{\text{tip}} - e(\text{Potential between MoS}_2 \text{ and tip})$$

$$\phi_{\text{HOPG}} = \phi_{\text{tip}} - e(\text{Potential between HOPG and tip})$$

$$\phi_{\text{MoS}_2} = \phi_{\text{HOPG}} + e(\text{Potential between HOPG and tip}) - e(\text{Potential between MoS}_2 \text{ and tip})$$

$$\phi_{\text{HOPG}} = 4.65 \text{ eV (well known)}$$

$$\text{Potential between HOPG and tip} = 0.367 \text{ V}$$

$$\phi_{\text{MoS}_2 \text{ on bare SiO}_2} = 4.65 \text{ eV} + 0.367 \text{ eV} - 0.607 \text{ eV} = 4.41 \text{ eV}$$

$$\phi_{\text{MoS}_2 \text{ on plasma-treated SiO}_2} = 4.65 \text{ eV} + 0.367 \text{ eV} + 0.116 \text{ eV} = 5.13 \text{ eV}$$

Fig. S3 Band diagrams with work function value of MoS₂ on both substrates

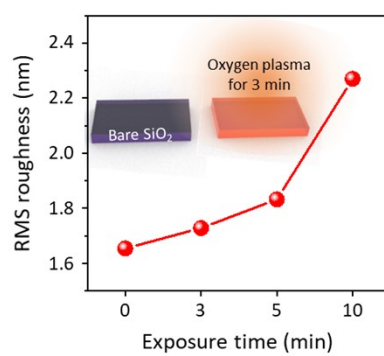


Fig. S4 RMS roughness of SiO₂ surface according to each oxygen plasma exposure time for 0 (bare SiO₂), 3, 5 and 10 min, respectively

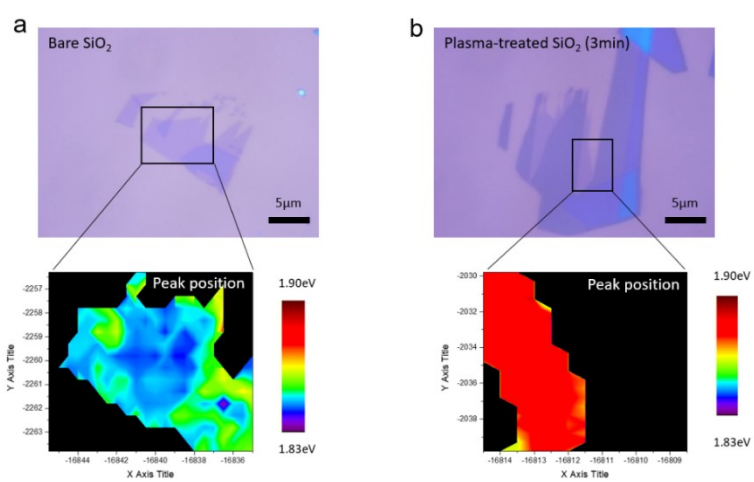


Fig. S5 PL peak position mapping images of (a) 1L MoS₂/bare SiO₂ and (b) 1L MoS₂/Plasma-treated SiO₂ (3 min)

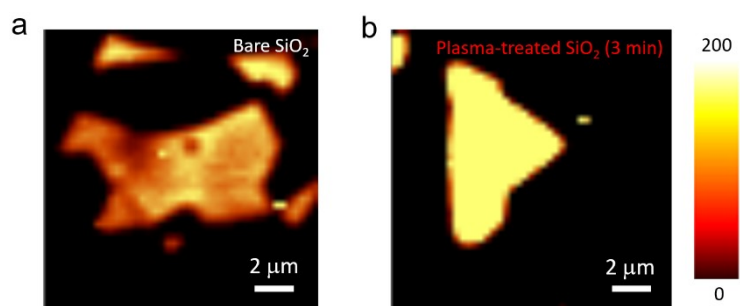


Fig. S6 PL intensity mapping images of (a) 1L MoS₂/bare SiO₂ and (b) 1L MoS₂/Plasma-treated SiO₂ (3 min)

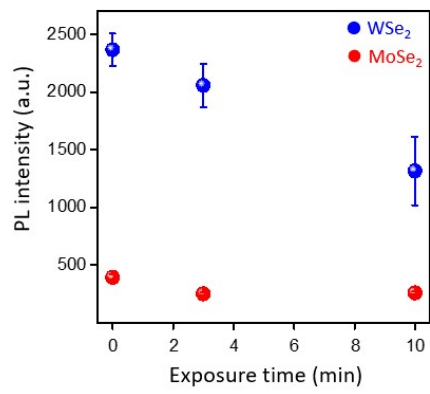


Fig. S7 Integrated PL intensity spectra of WSe₂ (Blue circled dots) and MoSe₂ (Red circled dots) as a function of oxygen plasma exposure time for different times from 1 to 10 min.

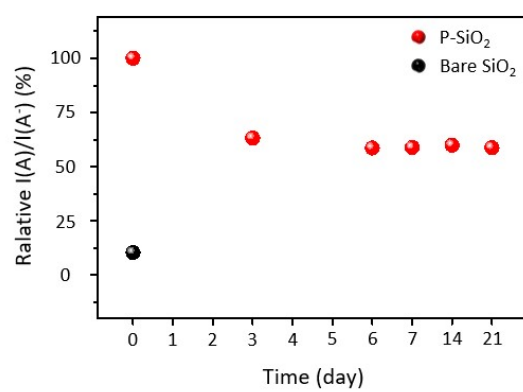


Fig. S8 Rate of reduction of relative PL intensity ratios between A and A⁻ (I_A/I_{A^-}) peaks of MoS₂/bare SiO₂ (Black dot) and MoS₂/Plasma-treated SiO₂ (Red dots) as a function of stability time to 21 days in the air

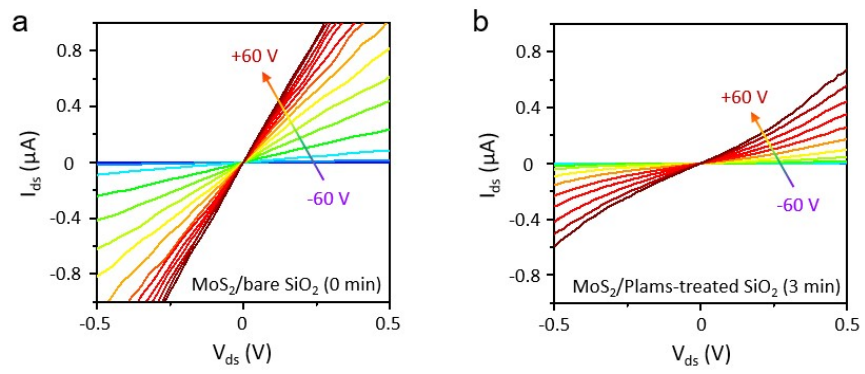


Fig. S9 (a) Output curve of MoS₂/Bare SiO₂ **(b)** Output curve of MoS₂/Plasma-treated SiO₂