Supporting Information

Facile passivation of black phosphorus nanosheets via silica coating for stable and efficient solar desalination

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Section S1. Preparation of BP nanosheets

The black phosphorus (BP) nanosheets were obtained by ultrasonic exfoliating bulk BP single crystals. Briefly, 50 mg of bulk BP was grounded into small pieces for 20 min using an agate mortar with a pestle. The black phosphorus powers were then transferred to 30 mL oxygen-free deionized (DI) water in a 40 mL sealed anaerobic vial. The suspension was sonicated with a ultrasonic cell disruption system (JY 88-11N) for 10 h at a power of 37.5 W. The ultrasound probe worked 2 s with the interval of 2 s. During the ultrasonication, the temperature of the sample solution was kept below 277 K by ice bath. The as-exfoliated BP dispersion was centrifuged at 1000 rpm for 20 min to remove the un-exfoliated BP crystals. Then the resulting supernatant was centrifuged at 4000 rpm for 30 min to obtain the precipitate of BP nanosheets. After that, the BP nanosheets were re-suspended in DI water.

Figure S1. Screenshot images from movie M1-M3 for equilibrium state of BP (a), SiO$_2$/BP-M (b) and SiO$_2$/BP-MT (c).

Figure S2. SEM images of BP (a), SiO$_2$/BP-M (b) and SiO$_2$/BP-MT (c).
**Figure S3.** The EDX mappings of BP (a), SiO$_2$/BP-M (b), and SiO$_2$/BP-MT (c).

**Figure S4.** The TEM images of BP (a), SiO$_2$/BP-M (b), and SiO$_2$/BP-MT (c).

**Figure S5.** The AFM images of BP (a), SiO$_2$/BP-M (b), and SiO$_2$/BP-MT (c).
**Figure S6.** High resolution XPS spectrum of BP.

**Figure S7.** High resolution XPS spectrum of SiO$_2$/BP-M.

**Figure S8.** High resolution XPS spectrum of SiO$_2$/BP-MT.
Figure S9. TGA curves of SiO$_2$, BP and SiO$_2$/BP-MT.

Figure S10. The evaporation rates of BP film- and SiO$_2$/BP-MT film-based evaporators for saturated salt solution and simulated seawater.

Table S1. The evaporation rates of different solar absorbers under irradiation.

<table>
<thead>
<tr>
<th>Solar absorber</th>
<th>Optical power density</th>
<th>Evaporation rate</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>GO film with a 2D water path</td>
<td>1 kW m$^{-2}$</td>
<td>1.45 kg m$^{-2}$ h$^{-1}$</td>
<td>1</td>
</tr>
<tr>
<td>carbon-black-based superhydrophobic</td>
<td>1 kW m$^{-2}$</td>
<td>0.1 L h$^{-1}$</td>
<td>2</td>
</tr>
<tr>
<td>Material</td>
<td>Power Density</td>
<td>Evaporation Rate</td>
<td>References</td>
</tr>
<tr>
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<tr>
<td>paper-based gold-nanoparticle film</td>
<td>4.5 kW m⁻²</td>
<td>1.71 mg s⁻¹</td>
<td></td>
</tr>
<tr>
<td>Au/D-NPT</td>
<td>1 kW m⁻²</td>
<td>1 kg m⁻² h⁻¹</td>
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<tr>
<td>wood–GO composite</td>
<td>12 kW m⁻²</td>
<td>14.02 kg m⁻² h⁻¹</td>
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</tr>
<tr>
<td>SiO₂/BP-MT film</td>
<td>1 kW m⁻²</td>
<td>1.63 kg m⁻² h⁻¹</td>
<td>Our study</td>
</tr>
</tbody>
</table>

References: