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Supporting information

Sustainable and self-cleaning bilayer coatings for high-efficient daytime radiative cooling

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1. Calculation of PDRC performance

The concept of passive daytime radiative cooling (PDRC) has attracted much attention as a potential solution to the energy crisis in recent years. PDRC requires high solar reflectance to minimize solar heat gain under direct sunlight, and high mid-infrared emittance to directly radiate energy into outer space at a temperature of ~ 3 K[1].

The solar reflectance ($\bar{R}_{solar}$) is calculated as the ratio of the reflected solar intensity across the solar spectrum (λ = 0.3–2.5 μm) to the integral solar intensity in the same range, as shown below:

$$\bar{R}_{solar} = \frac{\int_{\lambda_1}^{\lambda_2} I_{solar}(\lambda) R(\lambda) d\lambda}{\int_{\lambda_1}^{\lambda_2} I_{solar}(\lambda) d\lambda}, \quad (1)$$

where $I_{solar}(\lambda)$ represents the ASTM G173-03 Global solar intensity spectrum at AM 1.5, $R(\lambda)$ is the spectral reflectance of the tested sample.

Similarly, the thermal emittance $\bar{\varepsilon}_{LWIR}$ is expressed as:

$$\bar{\varepsilon}_{LWIR} = \frac{\int_{\lambda_1}^{\lambda_2} I_{bb}(T,\lambda) \varepsilon(T,\lambda) d\lambda}{\int_{\lambda_1}^{\lambda_2} I_{bb}(T,\lambda) d\lambda}, \quad (2)$$

where $I_{bb}(T,\lambda)$ is the spectral intensity emitted by a standard blackbody with a temperature of T (25 °C), $\varepsilon(T,\lambda)$ represents the sample's spectral emittance. $\bar{\varepsilon}_{LWIR}$ is for wavelengths in the LWIR window (λ = 8-13 μm).

2. CA with increasing ratio of NaCl and PDMS

Increasing the porosity of the hydrophobic layer (ρ_1) can effectively enhance the surface roughness, thereby improving the hydrophobicity. When m_{PDMS}/m_{NaCl} increases from 10:1 to 14:1 for the hydrophobic layer, there is no significant increase of the surface roughness, thereby the CA value only increases from 163° to 165° (Figure S1).

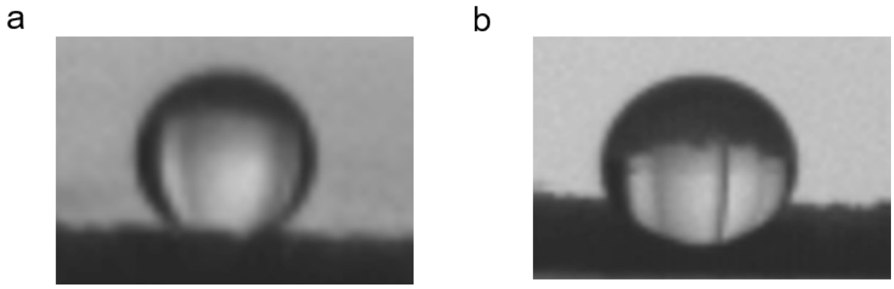

Figure S1 The CA value of coatings with different ratios of NaCl and PDMS (a) 10:1 and (b)14:1.

3. NaCl particles with different radii

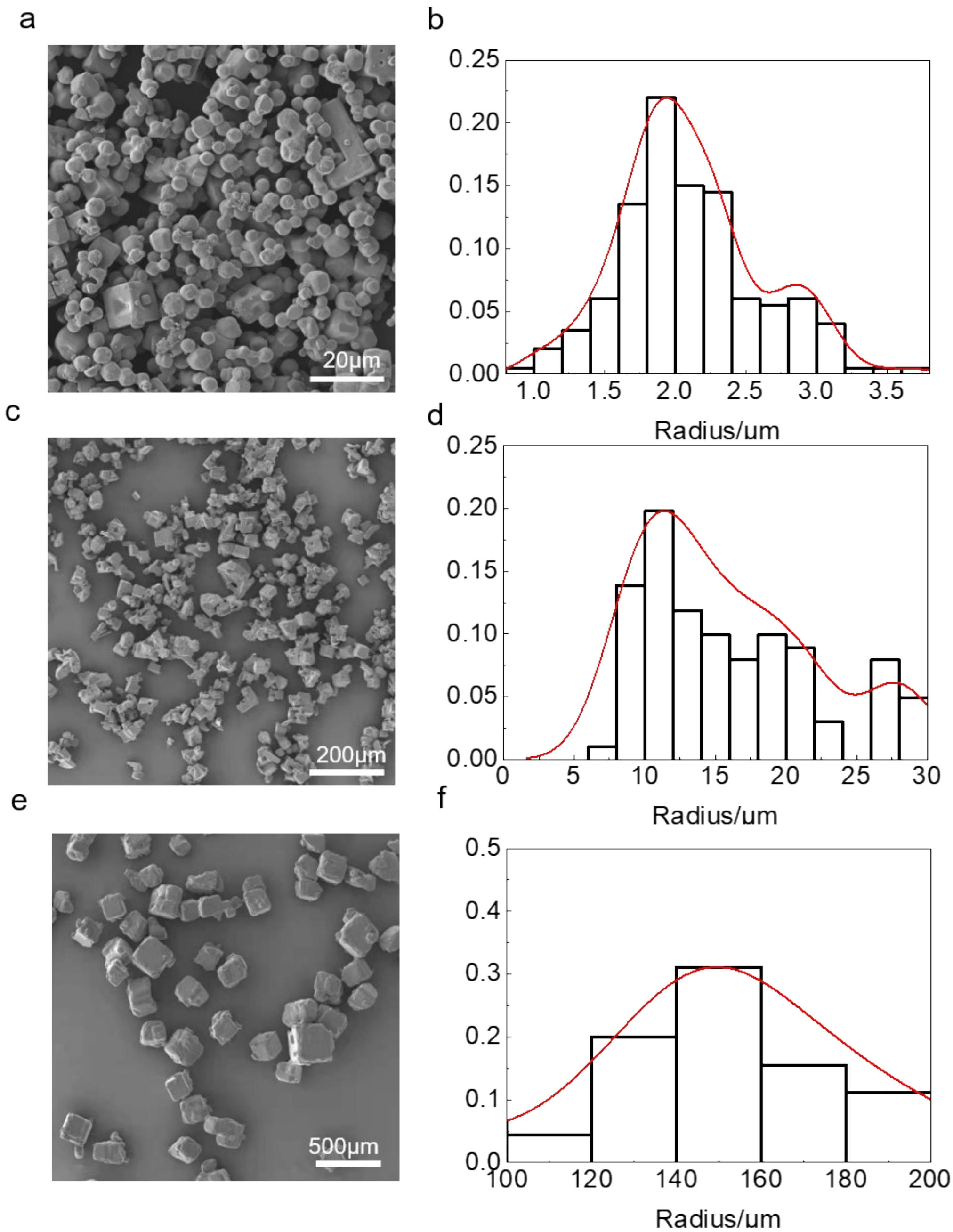

Figure S2 (a), (c), (e) The SEM and (b) (d) (f) the size analysis of NaCl particles (r = ~ 2 μm, 16 μm and 158 μm).

Table S1 Different radii of NaCl particles under different preparation conditions

Radius (μm)	**Saturated NaCl solution (mL)**	**EtOH (mL)**	**Drop rate (mL/min)**	**Temperature (°C)**	**Time (min)**
2	0.4	20	0.4	30	10
16	3.6	180	0.4	30	20

References

[1] X. Nie, Y. Yoo, H. Hewakuruppu, J. Sullivan, A. Krishna, and J. Lee, “Cool White Polymer Coatings based on Glass Bubbles for Buildings,” *Sci. Rep.*, vol. 10, no. 1, pp. 1–11, 2020, doi: 10.1038/s41598-020-63027-2.