Supporting information

Fabrication of Mechanically Robust, Self-cleaning and Optically High-performance Hybrid Thin Films by SiO$_2$&TiO$_2$ Double-Shelled Hollow Nanospheres

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Figure S1. X-ray diffraction (XRD) patterns of SiO₂&TiO₂ DSHN powder.

Scherrer equation

\[ D = 0.89 \frac{\lambda}{(\beta \cos \theta)} \] (1), where 2θ is the diffraction angle, \( \lambda \) is the wavelength of X-ray radiation, and \( \beta \) is the full width at the half-maximum of the diffraction peak.

Figure S2. IR spectrum of SiO₂&TiO₂ DSHN powder.
Figure S3. AFM images of (a) SiO$_2$ HN thin film and (b) SiO$_2$&TiO$_2$ DSHN thin film.

Figure S4. (a) Transmission spectra of SiO$_2$ HN thin film before and after washing test. (b) SEM image of SiO$_2$ HN thin film after washing test.