SUPPORTING INFORMATION

Macroporous Transport - Mesoporous Catalysis: A Rapid Microfluidic-Fabricated Biomimetic Sponge Photocatalytic Microsphere Reactor

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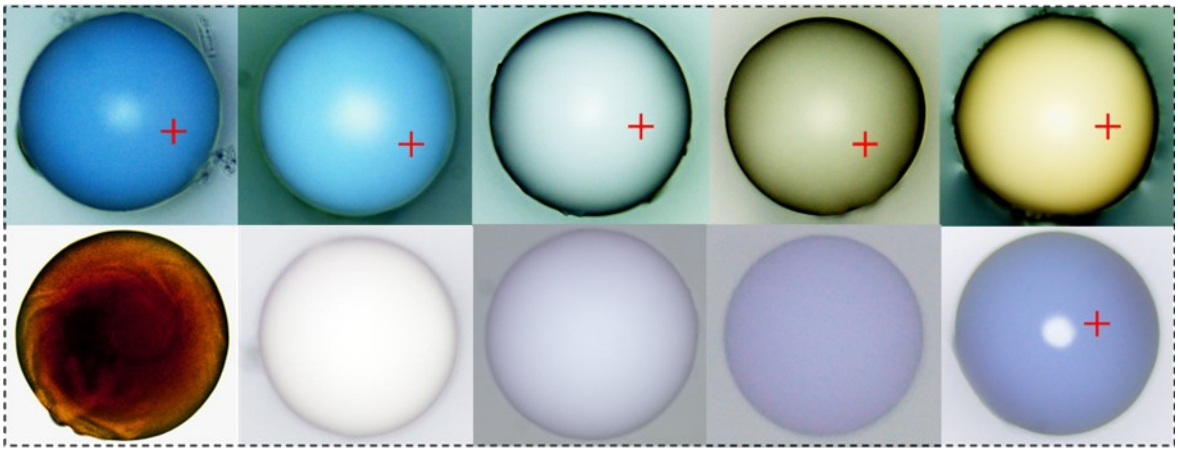

Figure S1. OM images of ST-PCMR with different structural colors in reflection mode.

In the preparation of SiO_2 nanoparticles (NPs) via the Sol–gel method, their particle size can be readily tuned by adjusting the amount of ammonia in the system. According to Bragg's diffraction law ($\lambda = 2nd \sin\theta$, where n is the effective refractive index, λ is the wavelength, d is the interplanar spacing, and θ is the incident angle), varying the particle size of the constituent grains in the bulk material will inevitably alter the reflection wavelength λ, thereby resulting in different optical colors.

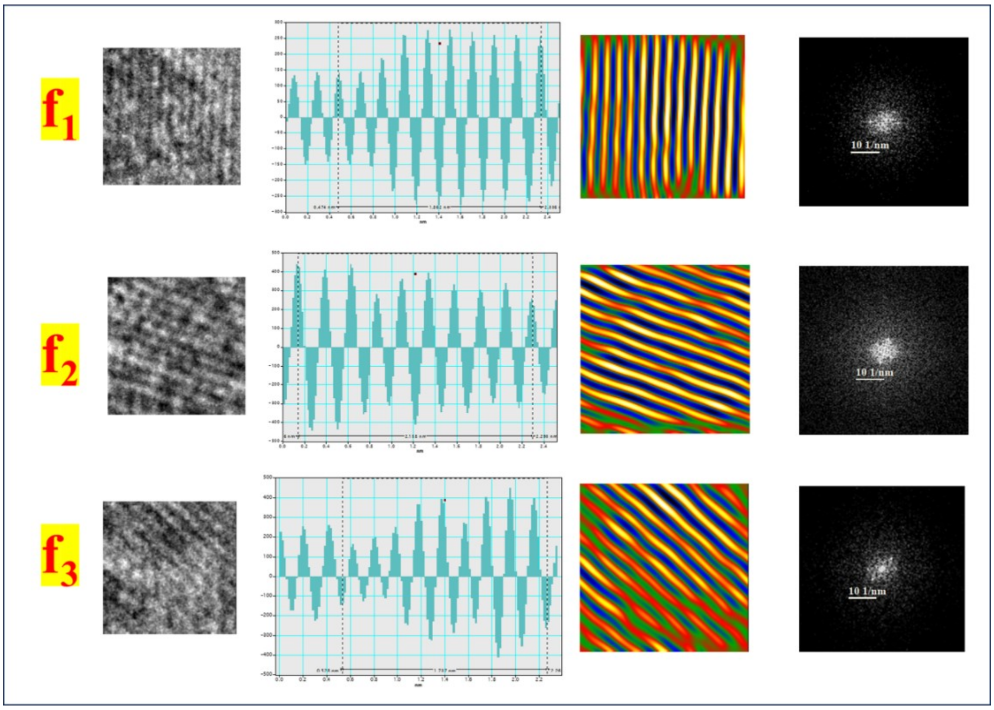

Figure S2. HRTEM images and selected area Fourier transform images of ST-PCMR-600 °C.

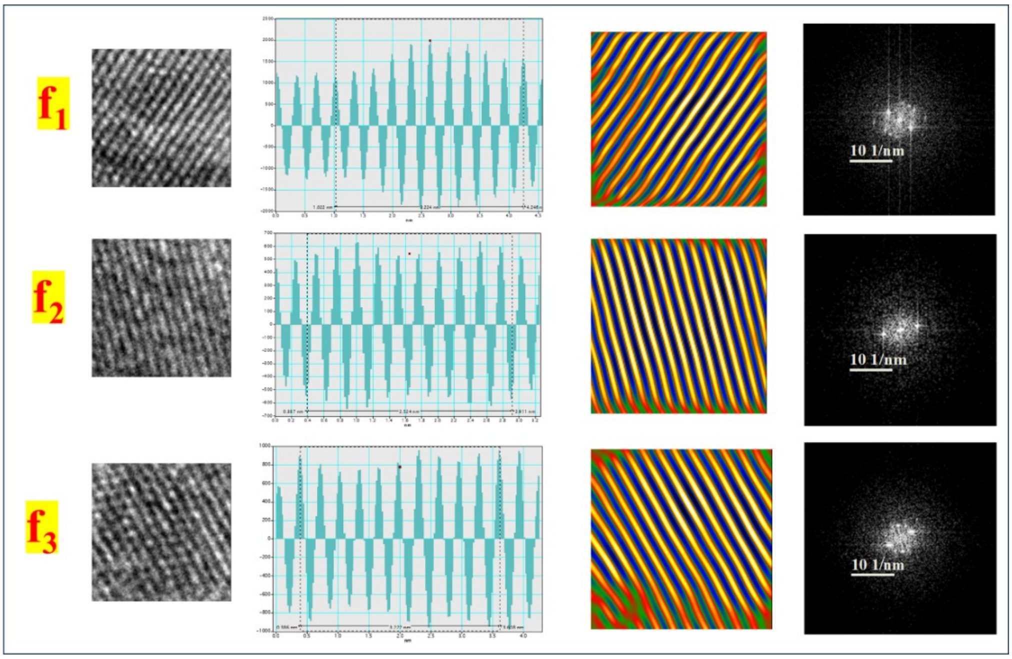

Figure S3. HRTEM images and selected area Fourier transform images of non-confined TiO_2.

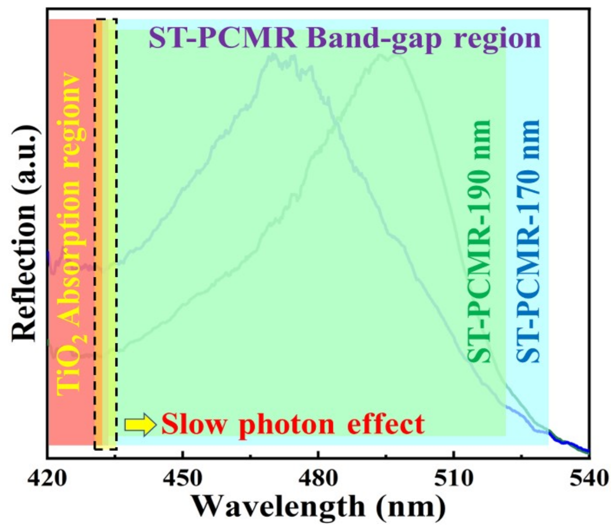

Figure S4. Correspondence between the PBG width of ST-PCMR and the absorption edge of confinement TiO_2.

By comparison, the ST-PCMR assembled from 170 nm SiO_2 NPs exhibits better matching between its PBG edge (422 nm) and the absorption edge of TiO_2 (430 nm), while the PBG center is closer to the absorption edge. This configuration significantly prolongs photon residence time within TiO_2 via the slow-photon effect, thus markedly enhancing band-edge light absorption. Moreover, the PBG width (428–538 nm) of ST-PCMR covers the weak absorption region of TiO_2, enabling efficient conversion of low-efficienncy green light (constituting 38% of solar spectrum) into active excitations through slow-photon amplification, thereby substantially improving overall solar energy utilization.

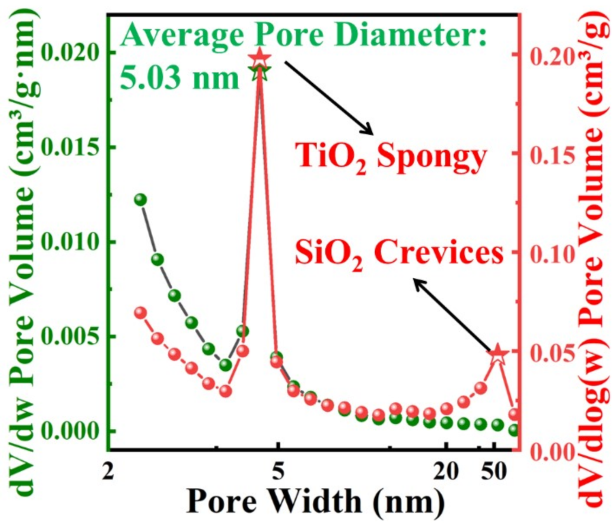

Figure S5. Pore size distribution of ST-PCMR-600 °C.

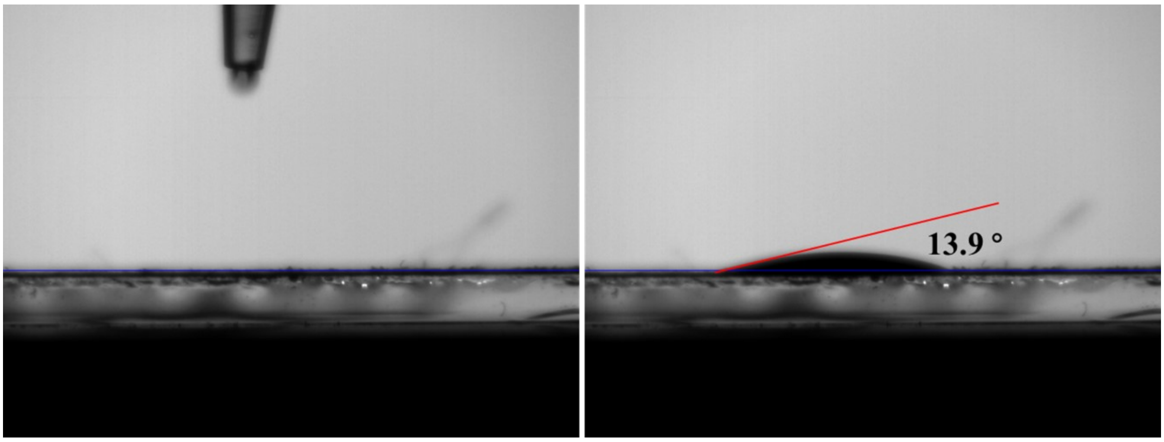

Figure S6. Contact angle of ST-PCMR-600 ℃.

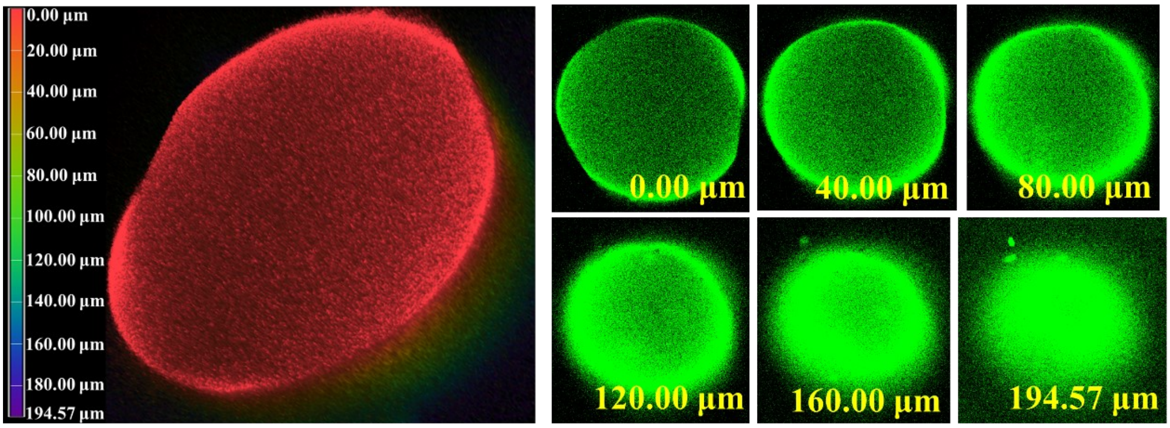

Figure S7. CLSM images of ST-PCMR-600 ℃.

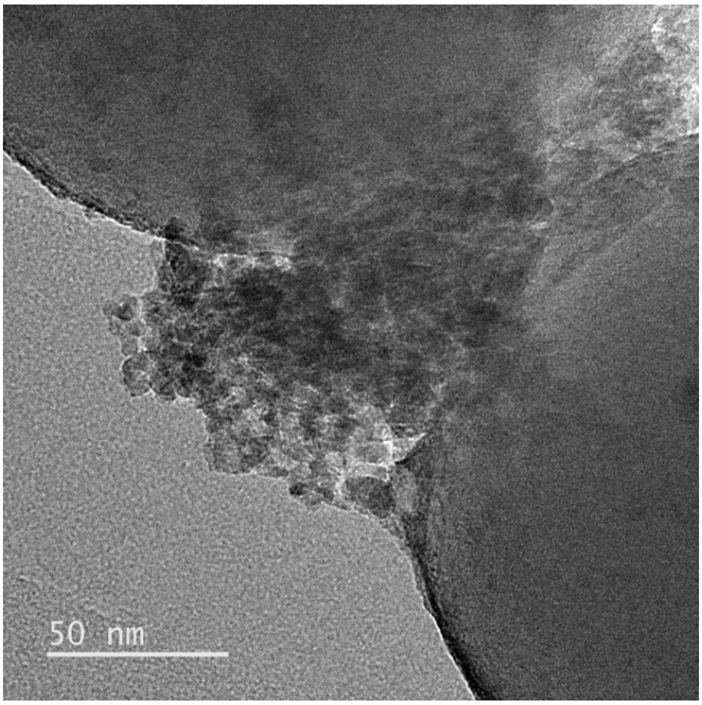

Figure S8. TEM image of TiO_2 confined within SiO_2 after five hydrogen production cycles.

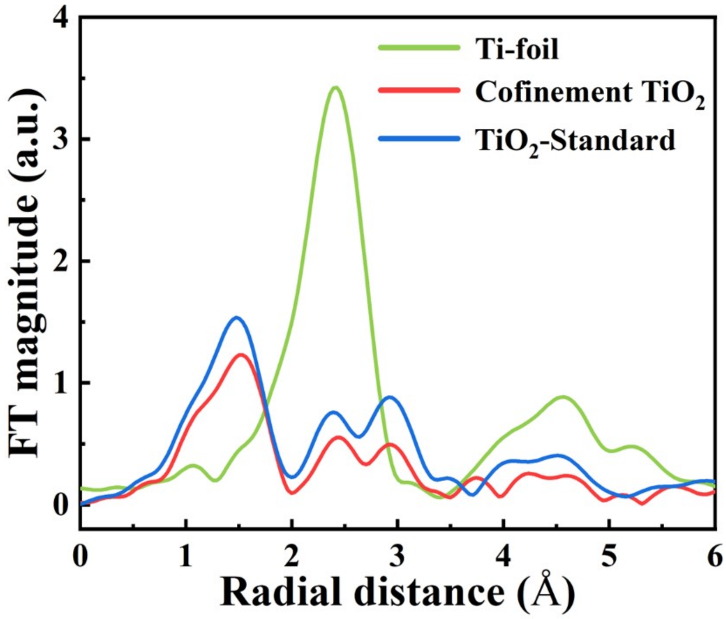

Figure S9. The corresponding FT-EXAFS curves at R space.