Supporting Information

Subwavelength Hollow-Nanopillared Glass with Gradient Refractive Index for Ultralow Diffuse Reflectance and Antifogging

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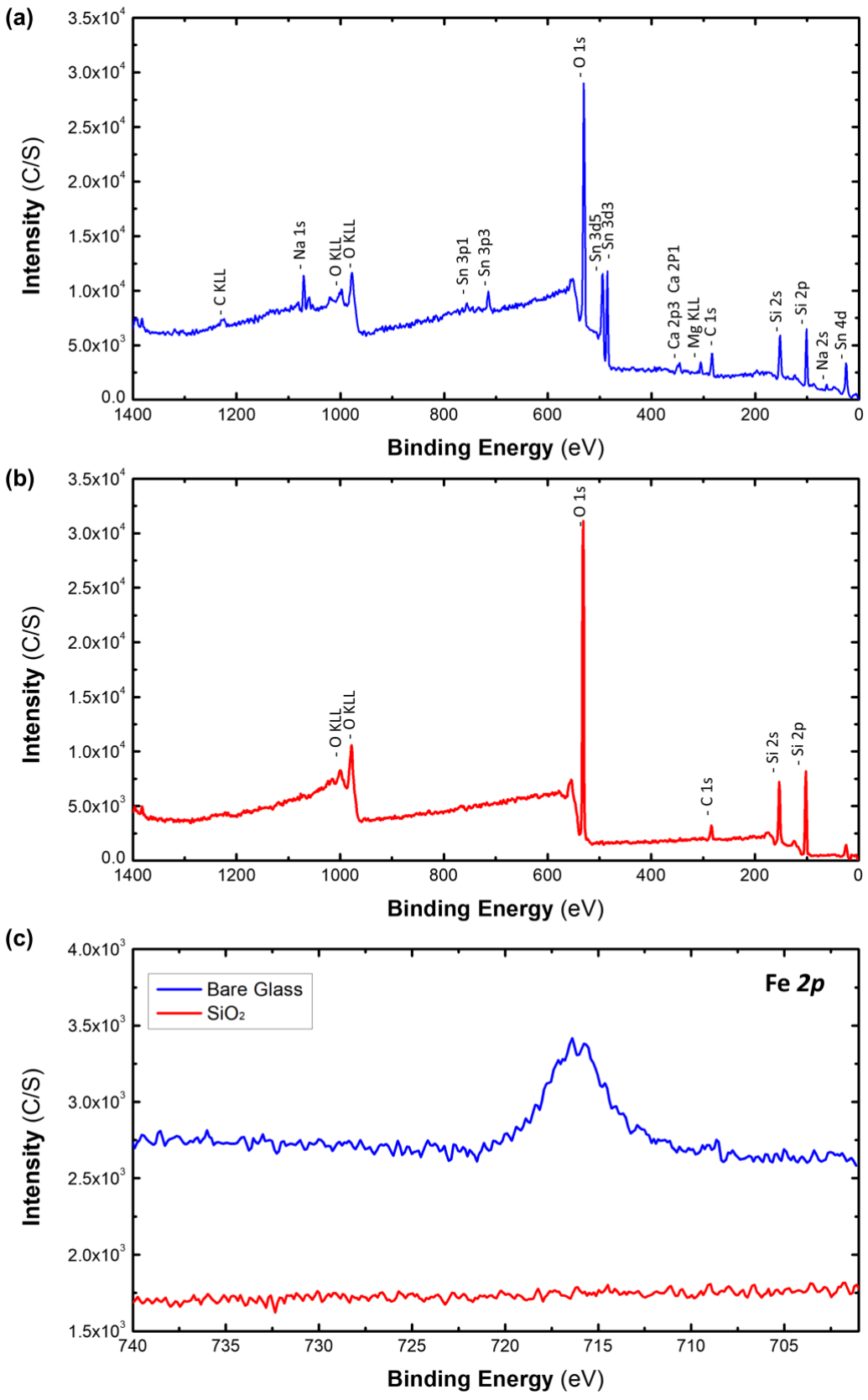

Figure S1. XPS analysis of (a) bare glass and (b) glass coated with sacrificial SiO_2 layer (thickness of SiO_2 layer is 250 nm) by PECVD, and (c) Fe *2p* for bare glass and the glass with sacrificial SiO_2 layer (thickness of SiO_2 layer is 250 nm).

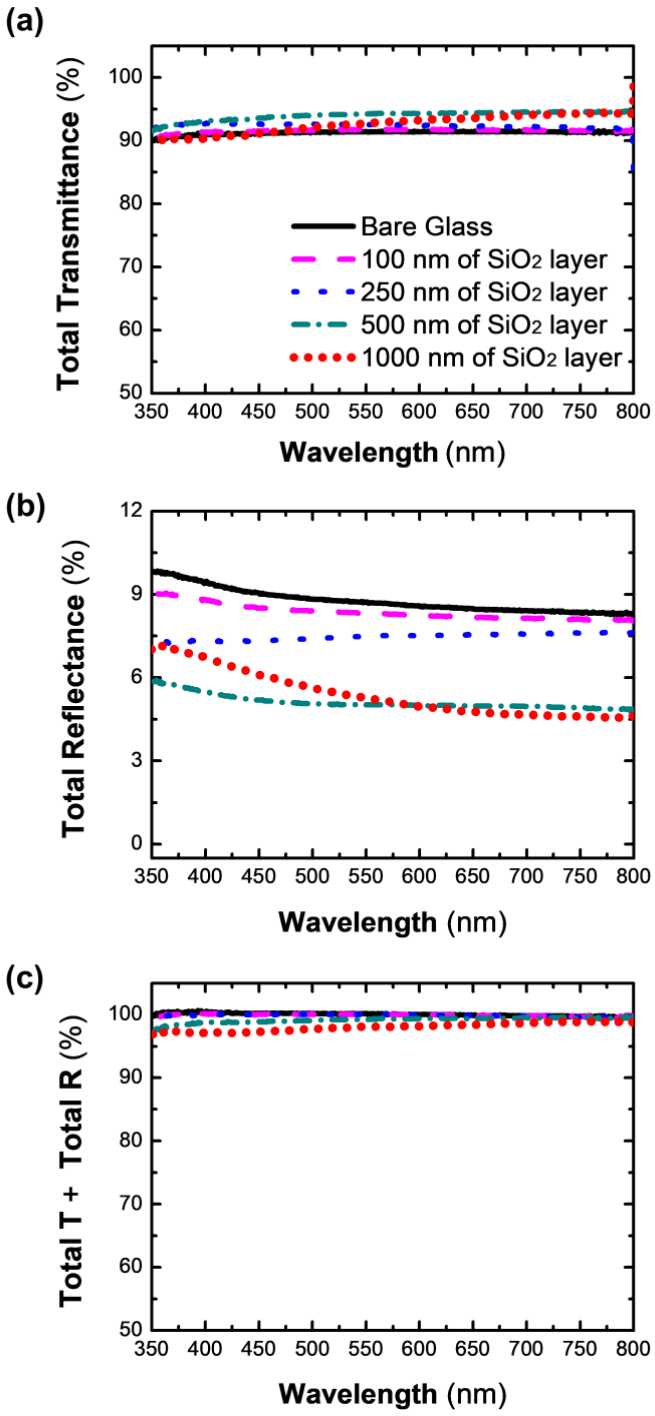

Figure S2. (a) Total transmittance, (b) total reflectance and (c) the sum of total transmittance and total reflectance. The optical performance can be represented by the total transmittance and the total reflectance (specular + diffuse reflectance). The total reflectance is the sum of specular and diffuse reflectance. We included the total sum of transmittance and reflectance in (c). The results showed that the sum of total transmittance and reflectance was nearly 100% in most of the wavelength range of 350 to 800 nm.

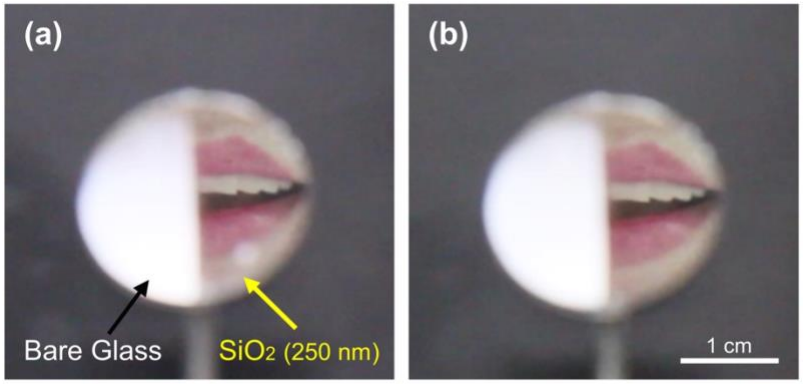

Figure S3. Two optical images of a dental mirrored glass with nanostructures on its right half (the thickness of SiO_2 layer is 250 nm), while bare is on the left half, showing sharp contrast in antifogging property after (a) the first and (b) the 100_{th} exhaled breath test (also see Movie S1).

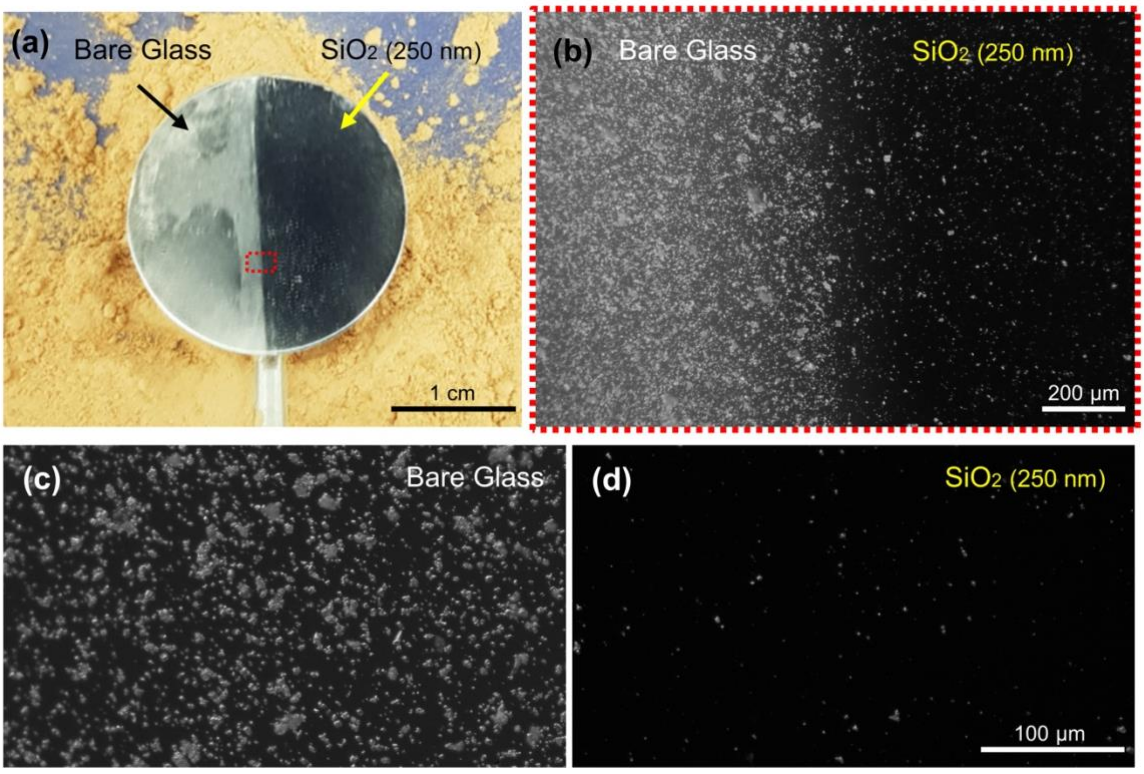

Figure S4. (a) An optical image of the mirrored glass having the bare glass side (left) and the nanostructured side (right) after the air blowing test. (b) A microscope image of the boundary region represented by the red dotted box in (a) and its magnified images for (c) the bare side and (d) the nanostructured side, showing a significant difference in dust number density (high for the bare side, but ultralow for the nanostructured side).

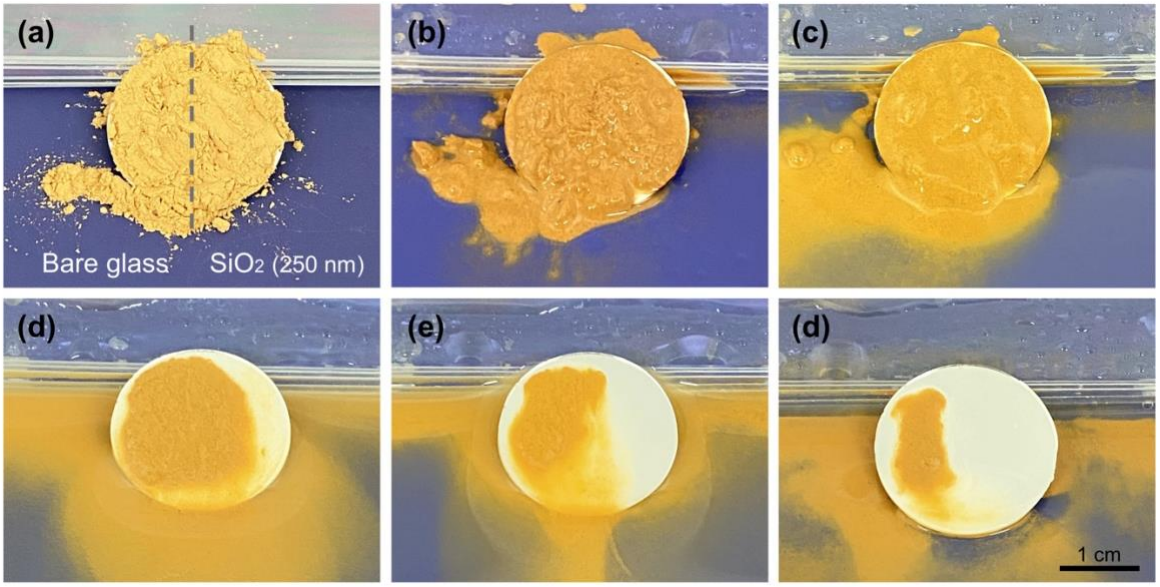

Figure S5. (a-f) Series of optical images of the mirrored glass having the bare glass side (left) and the nanostructured side (right), showing the removal of fine sand dust particles by spraying water with easy cleaning nature on the nanostructured side.

Figure S6. Optical images of water droplets on three lenses (a) without or (b) with water droplets: Bare lens (left) without plasma etching and surfaces prepared with either 250 nm (middle) or 500 nm (right) SiO_2 layer (with CF_4 plasma etching for 15 or 30 min, respectively). Water droplets of approximately 5 μL were gently deposited onto the surfaces using a micro-pipet. Nanostructured lenses showed a water layer on the surfaces, whereas the bare lens showed water droplets.

Etch time	Hydrolysis process in water	C 1s	O 1s	F 1s	Si 2p	Fe 2p
5 min	Before	25.28	25.28	49.69	9.29	1.15
	After	26.31	56.60	3.17	12.86	1.06
10 min	Before	21.54	24.5	48.33	3.27	2.31
	After	21.74	55.78	4.15	17.66	0.67

Table S1. Atomic concentration of CF_4 plasma-etched glass surfaces (thickness of SiO_2 layer is 250 nm) before and after the hydrolysis process in water.

Movie S1. A movie clip of a dental mirrored glass showing antifogging behavior after exhaled breath test for 100 cycles. The bare surface is on the left half and the nanostructured surface (thickness of SiO_2 layer is 250 nm) is on the right.

Movie S2. A movie clip of a dental mirrored glass showing easy cleaning behavior during sand dust particles removal test. The bare surface is on the left half and the nanostructured surface (thickness of SiO_2 layer is 250 nm) is on the right.

Supplementary Method

X-ray photoelectron spectroscopy

Compositional analyses for the surface were performed using X-ray photoelectron spectroscopy (XPS; PHI 5000 Versa Probe, Ulvac-PHI) to investigate the chemical elements on bare glass, SiO_2 layer (thickness of SiO_2 layer is 250 nm) before and after plasma etching (etch time = 5 min, 10 min). An Al Kα (1486.6 eV) X-ray source was used for XPS measurements. X-ray source anode was maintained at 25 W (15 kV) with a 100 × 100-μm beam spot.