Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Interferometric Nanoporous Anodic Alumina Photonic Coatings for Optical Sensing

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S1. Real-Time Monitoring of ΔOT_{eff} in RIfS

Figure S1 depicts an example of calculation ΔOT_{eff} by applying FFT to the RIfS spectrum of a NAA-DBR after infiltration of its nanopores with different solutions and real-time monitoring of effective optical thickness change in a NAA-DBR structure produced with a periodicity of 900 s and 150 anodization pulses. As **Figures S1a and b** show, the RIfS spectrum of NAA-DBRs features a maximum of reflection as well as periodically distributed fringes across the spectrum. The application of FFT to the RIfS spectrum of NAA-DBRs makes it possible to estimate in an accurate manner the effective optical thickness of the film. Furthermore, as **Figure S1c** depicts, ΔOT_{eff} experiences sharp changes after the nanopores of the NAA-DBR photonic coating were filled with liquids of different refractive index (n_{water} = 1.333 RIU, $n_{glucose\ 0.5M}$ = 1.349 RIU, $n_{ethanol}$ = 1.362 RIU and $n_{isopropanol}$ = 1.378 RIU). Note that the total effective optical thickness change was calculated as the difference between the corresponding effective optical thickness and the effective optical thickness of the film when infiltrated with water.

$$\Delta OT_{eff}(Glucose\ 0.5M) = OT_{eff}(Glucose\ 0.5M) - OT_{eff}(Water)$$

$$\Delta OT_{eff}(Ethanol) = OT_{eff}(Ethanol) - OT_{eff}(Water)$$

$$\Delta OT_{eff}(Isopropanol) = OT_{eff}(Isopropanol) - OT_{eff}(Water)$$

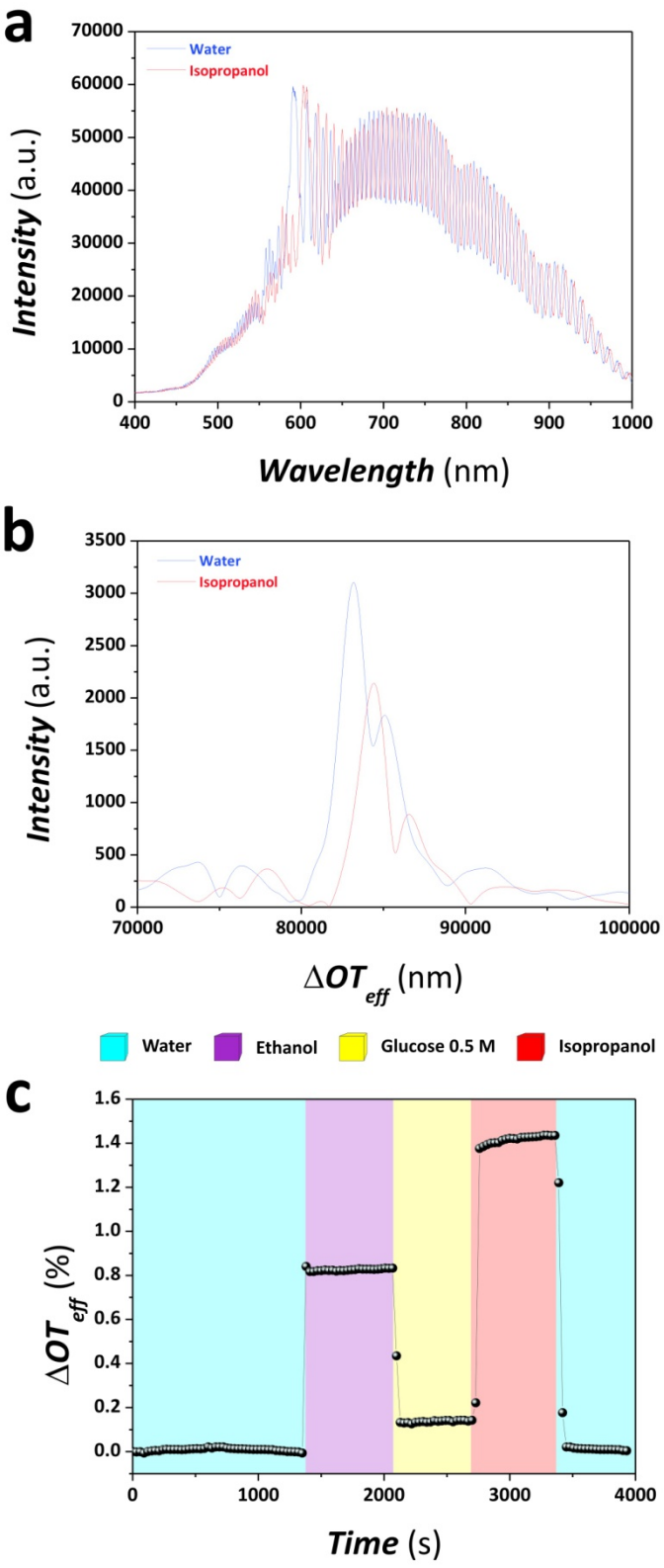

Figure S1. Example of real-time monitoring of effective optical thickness change in a NAA-DBR photonic coating (i.e. NAA-$DBR_{900\text{-}150}$) after infiltration with ethanol, glucose 0.5 M and isopropanol, respectively.

S2. Demonstration of Colorimetric Sensing Properties of NAA-DBRs

According to the Fabry–Pérot relationship, the effective optical thickness of NAA-DBR photonic coatings experiences a shift toward longer wavelengths if their nanopores are infiltrated by liquids or gases of higher refractive index than air. NAA-DBR photonic coatings present a highly nanoporous structure (**Figures S2a and b**), which makes it possible to achieve high contrasts of effective refractive index when their nanopores are infiltrated by liquids. **Figure S2c** demonstrates that these photonic coatings experience a sharp red shift in color when their nanopores are filled with a medium with higher refractive index than air (e.g. air – n_{air} = 1 RIU and isopropanol – $n_{isopropanol}$ = 1.378 RIU).

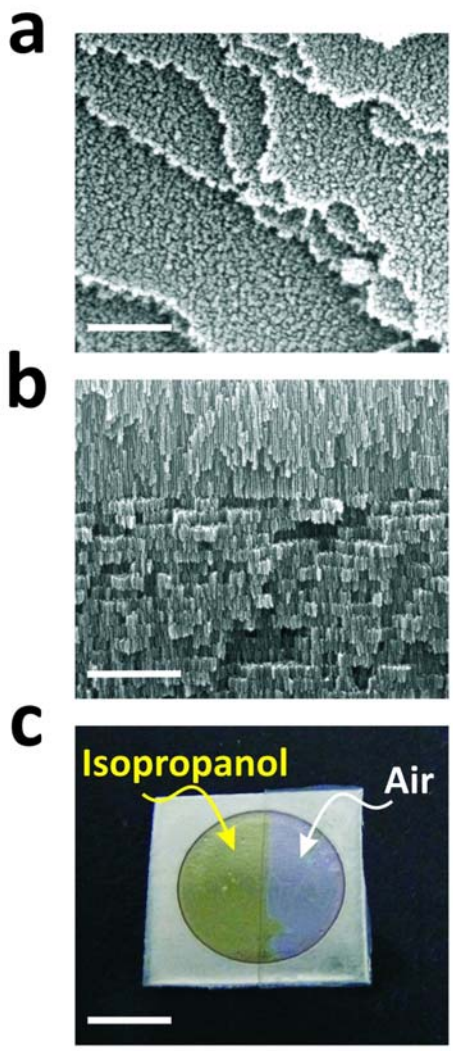

Figure S2. Demonstration of colorimetric sensing in NAA-DBRs. a-b) Top and cross-section view SEM images of a NAA-DBR photonic coating (scale bars = 500 nm and 1 μm, respectively). c) Digital image of a NAA-DBR (NAA-$DBR_{675\text{-}150}$) showing a partial change in color after infiltrating its nanopores with isopropanol (scale bar = 0.5 cm). Note that half NAA-DBR coating was covered with transparent tape in order to avoid the infiltration of its nanopores with isopropanol.

S3. Linearity of NAA-DBRs

Figure S3 and **Table S1** summarize the obtained results of linearity for the different NAA-DBRs analyzed in this study.

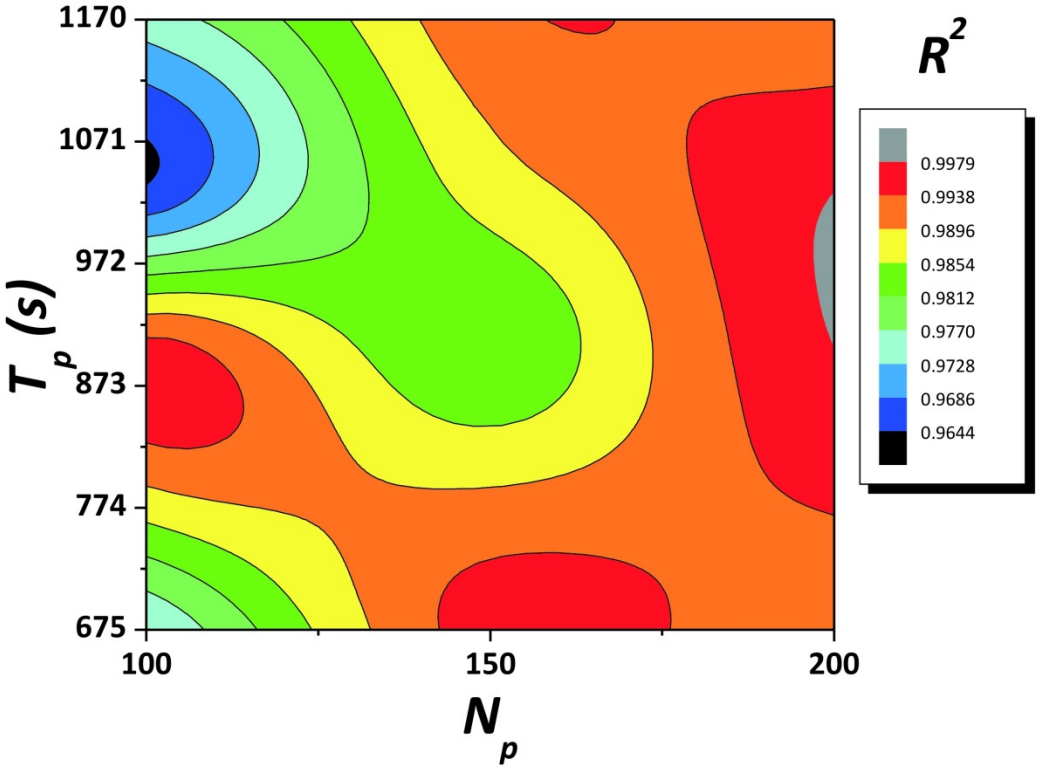

Figure S3. Contour plot showing the distribution of the linearity of NAA-DBR photonic coatings obtained from Figure 5 in the manuscript.

Table S1. Optical linearity of NAA-DBR photonic coatings assessed by RIfS after infiltration with glucose, ethanol and isopropanol.

NAA-DBR	R^2
$NAA\text{-}DBR_{(675\text{-}100)}$	0.9729
$NAA\text{-}DBR_{(900\text{-}100)}$	0.9957
$NAA\text{-}DBR_{(1035\text{-}100)}$	0.9645
$NAA\text{-}DBR_{(1170\text{-}100)}$	0.9749
$NAA\text{-}DBR_{(675\text{-}150)}$	0.9959
$NAA\text{-}DBR_{(900\text{-}150)}$	0.9814
$NAA\text{-}DBR_{(1035\text{-}150)}$	0.9876
$NAA\text{-}DBR_{(1170\text{-}150)}$	0.9929
$NAA\text{-}DBR_{(675\text{-}200)}$	0.9909
$NAA\text{-}DBR_{(900\text{-}200)}$	0.9978
$NAA\text{-}DBR_{(1035\text{-}200)}$	0.9978
$NAA\text{-}DBR_{(1170\text{-}200)}$	0.9913