Supplementary Information

Preparation of particulate suspensions. TiO_2 nanoparticulated sols were synthesized using a procedure based on the hydrolysis of titanium tetraisopropoxide ($Ti(OCH_2CH_2CH_3)_4$, 97% *Aldrich*) as it has been described before.[1] Briefly, titanium tetraisopropoxide was added to Milli-Q water. The white precipitate was filtered and washed several times with distilled water. The resultant solid was peptized in an oven at 120º C for 3 hours with tetramethylammonium hydroxide (*Fluka*). Finally, the suspension obtained was centrifuged at 14.000 rpm for 10 minutes. SiO_2 nanocolloids were purchased from Dupont (LUDOX TMA, *Aldrich*).Both suspensions were diluted in methanol to 4% wt..for TiO_2 and 2.5%wt or 2% wt for SiO_2 particles.

Deposition of nanoparticle based one-dimensional photonic crystals. Photonic crystals were built by an alternated deposition of TiO_2 and SiO_2 nanoparticulated suspensions, following a generic procedure previously reported by our group.[9] These sols were deposited over glass slides using a spin coater (Laurell WS-400E-6NPP) in which both the acceleration ramp and the final rotation speed could be precisely determined. The first layer was deposited using 250 microlitres of SiO_2 sol and the substrate was tilted and rotated to let the suspension cover the total glass surface. Then, the sample was accelerated up to different final speed using also several ramps in each case, in order to test the effect of these parameters. Final speed was chosen between nominal values of 4000 and 6000 revolutions per minute (rpm) and accelerations were selected between nominal 4550 and 7150 rpm s^{-1}. The total spin-coating process (ramping-up and final speed) is completed in 60 seconds. Afterwards, the coated sample is maintained at 25ºC during five minutes in a closed chamber. Sequentially, another layer of a different type of nanoparticle is deposited following the procedure described above.

The process is repeated until a total of twelve layers have been deposited. FESEM images of the multilayers films were taken using a microscope Hitachi 5200 operating at 2 kV.

Infiltration of polycarbonate, lifting off and transferring. As-grown multilayers were infiltrated with a 5% solution of Poly(bisphenol-A-carbonate) in methlyene chloride warmed at 30ºC±2ºC. Strict control over temperature within this range is crucial to ensure that the whole nanometer size void interstices of the multilayer are embedded, since at lower temperatures the increase of viscosity prevents total infiltration, and at higher ones evaporation of the solvent is too fast as to allow proper diffusion of the precursor. Infiltration was made by depositing the Poly(bisphenol-A-carbonate) solution onto the nanoparticle packing, allowing for the structure to be embedded, and then spin-coating at 6000 r.p.m. for 40 seconds. The hybrid films so obtained were heated at 60ºC during 2 hours to remove solvent traces. In order to attain self-standing membranes, the polycarbonate filled multilayer films were peeled off using mechanical traction from one vertex of the substrate. Then, these films could be transferred to different types of substrates and put into conformal contact by applying some mild pressure. To prevent undulations, films are previously wetted with an appropriate solvent (water, ethanol or methanol).

Optical Measurements. Reflectance spectra were performed using a Fourier Transform infrared spectrophotometer (Bruker IFS-66 FTIR) attached to a microscope and operating in reflection mode with a 4X objective with 0.1 of numerical aperture (light cone angle ±5.7º). Reflectance spectra were acquired from the geometrical center of the sample to the border of the glass substrate in a straight line to the center of the side with a periodicity of 2 mm. The images of the films were acquired using a digital camera (Canon EOS 400D).

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[1] Burnside, S.D.; Shklover, V.; Barbé, C.; Comte, P.; Arendse, F.; Brooks, K.; Grätzel, M., *Chem. Mater.* **1998**, *10*, 2419.