Supporting Information

Figure S.1a shows a typical transmittance spectrum of a thin colloidal crystal. Colloidal crystals assembled from monodisperse silica particles have been known for a long time to produce Bragg diffraction of light in the optical region. The photonic band structure of a colloidal crystal can be probed experimentally by measuring its transmission spectra using electromagnetic waves with different wavelengths. The bandgap is usually characterized by three parameters: the position of the midgap (λ_{min}), the width of the gap ($\Delta\lambda$), and the peak intensity. The position, width at half-maximum of the peak, and attenuation of the Bragg diffraction peak can be described by the dynamic scattering theory that was originally put forward by Zachariasen for X-ray diffraction.

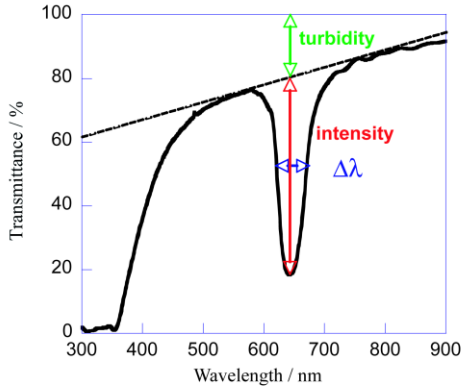
The peak intensity increases with the thickness of a colloidal crystal when the thickness is thin enough. However, the increase in the intensity is saturated above a certain thickness (S. 1b). Also, the crystal reaches its limiting bandwidth at a certain thickness (S. 1d). For a colloidal crystal of high dielectric contrast, diffraction is very strong, and the amplitude of the radiation attenuates rapidly with the propagation distance into the crystal. Moreover, the increase in the turbidity with the thickness also affects these optical properties. The same is true in the case of an inverse opal membrane.

In the case of the silica colloidal crystal in S.1b, the peak intensity is saturated above about 22 layers. In the case of the IOP, the peak intensity is lineally increased with the thickness up to 45 layers of the template. Thus, we used the silica colloidal crystal of 30 layers.

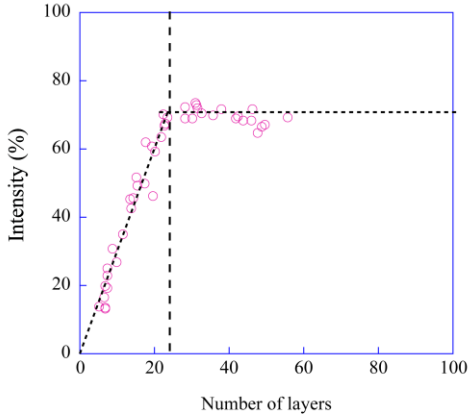
Figure S. 2 shows the swollen cylindrical NIPA gel and the collapsed cylindrical NIPA gel connected with the glass capillary. To determine the swelling ratio of the gel, the inner diameter of the glass capillary was used as a referenced size, D_0.

Figure S. 3a and 3b show the experimentally obtained refractive indices of NIPA gel, and water, and IOP, porous portion including NIPA gel particles and water, and GIP, depending on temperature, respectively.

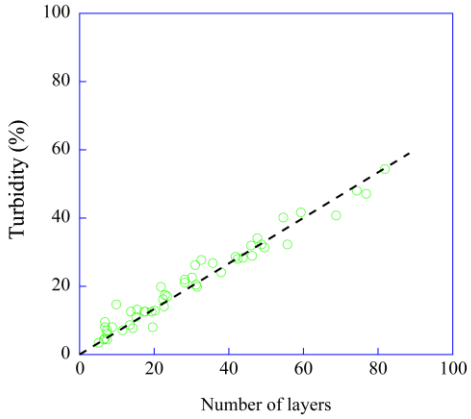
a)


turbidity
intensity
Δλ
Transmittance / %
Wavelength / nm

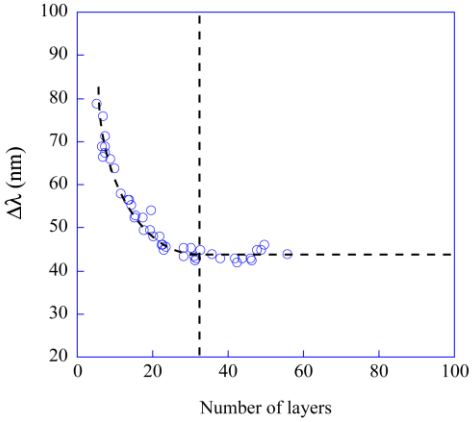
b)


Intensity (%)
Number of layers

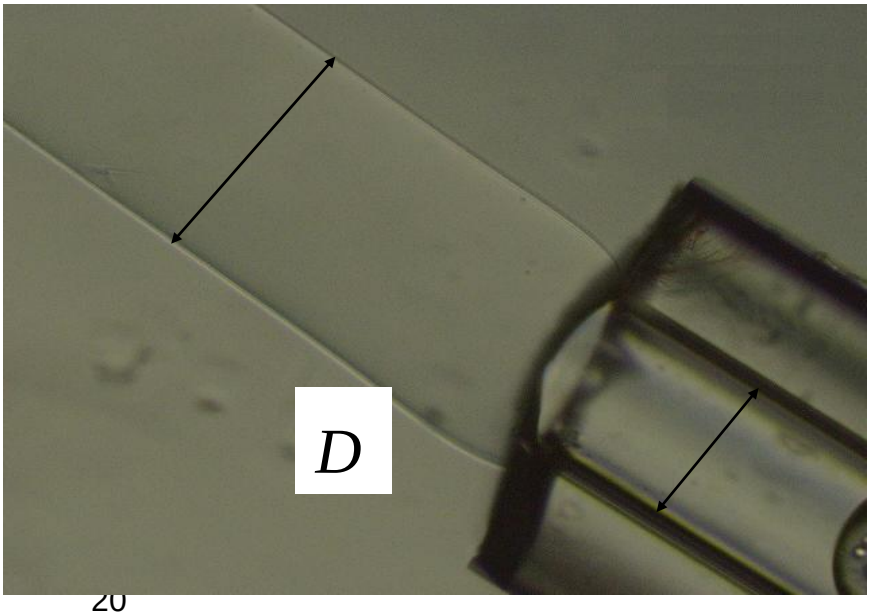
c)


Turbidity (%)
Number of layers

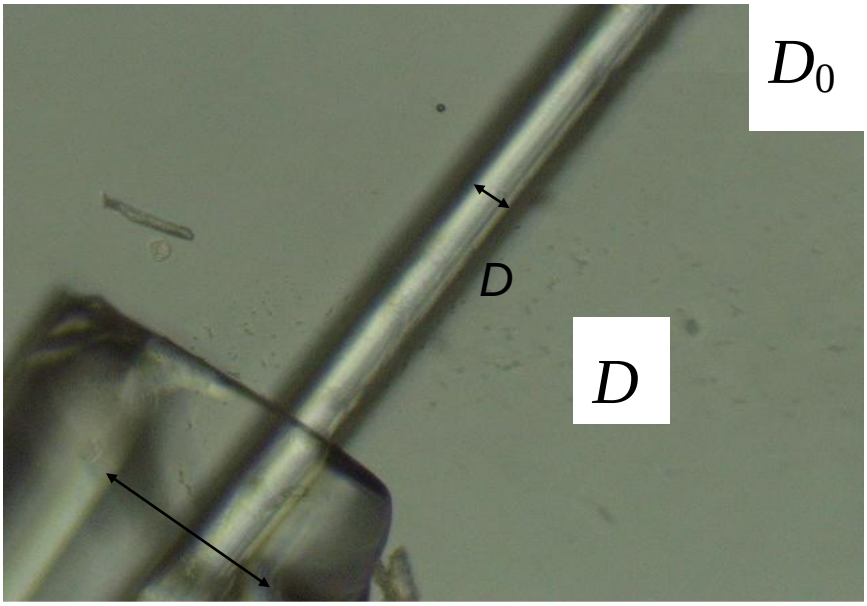
d)


Δλ (nm)
Number of layers

S. 1

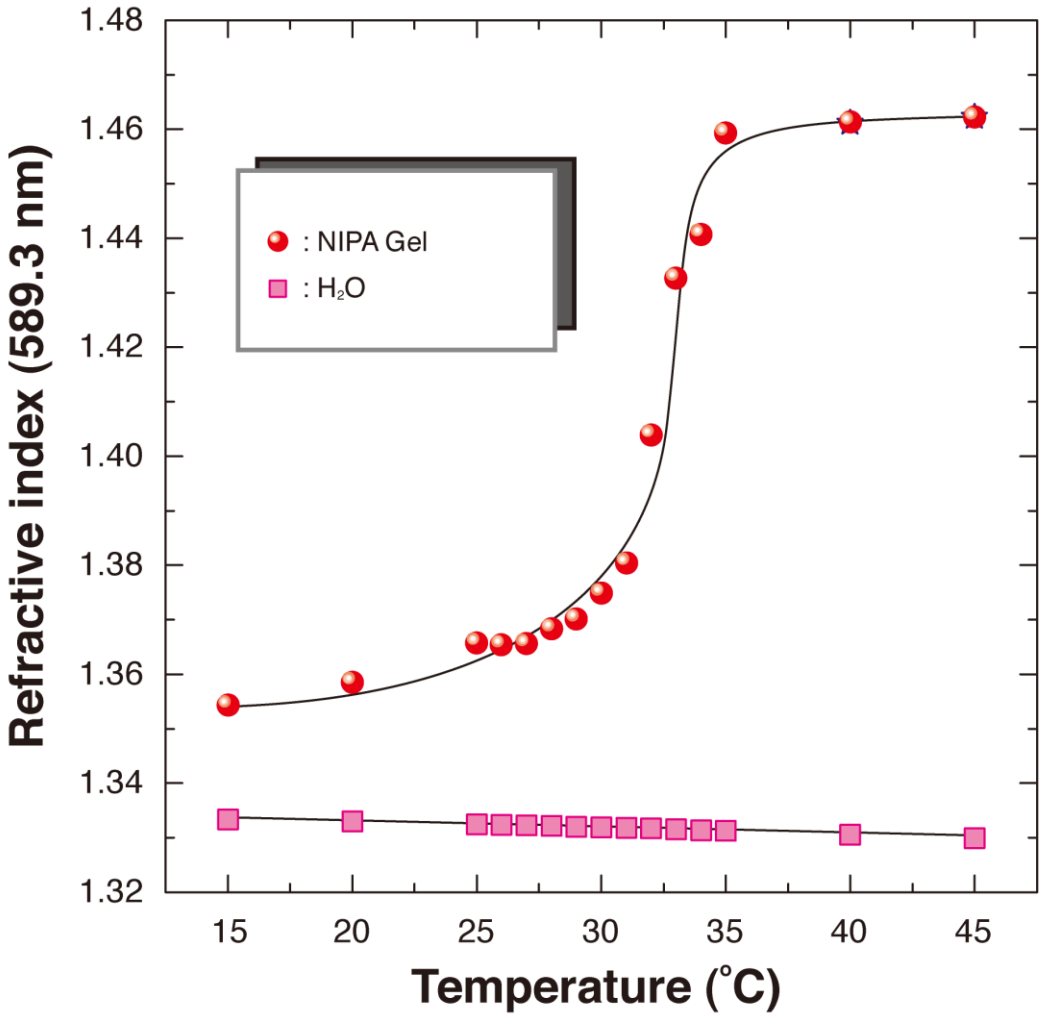


20

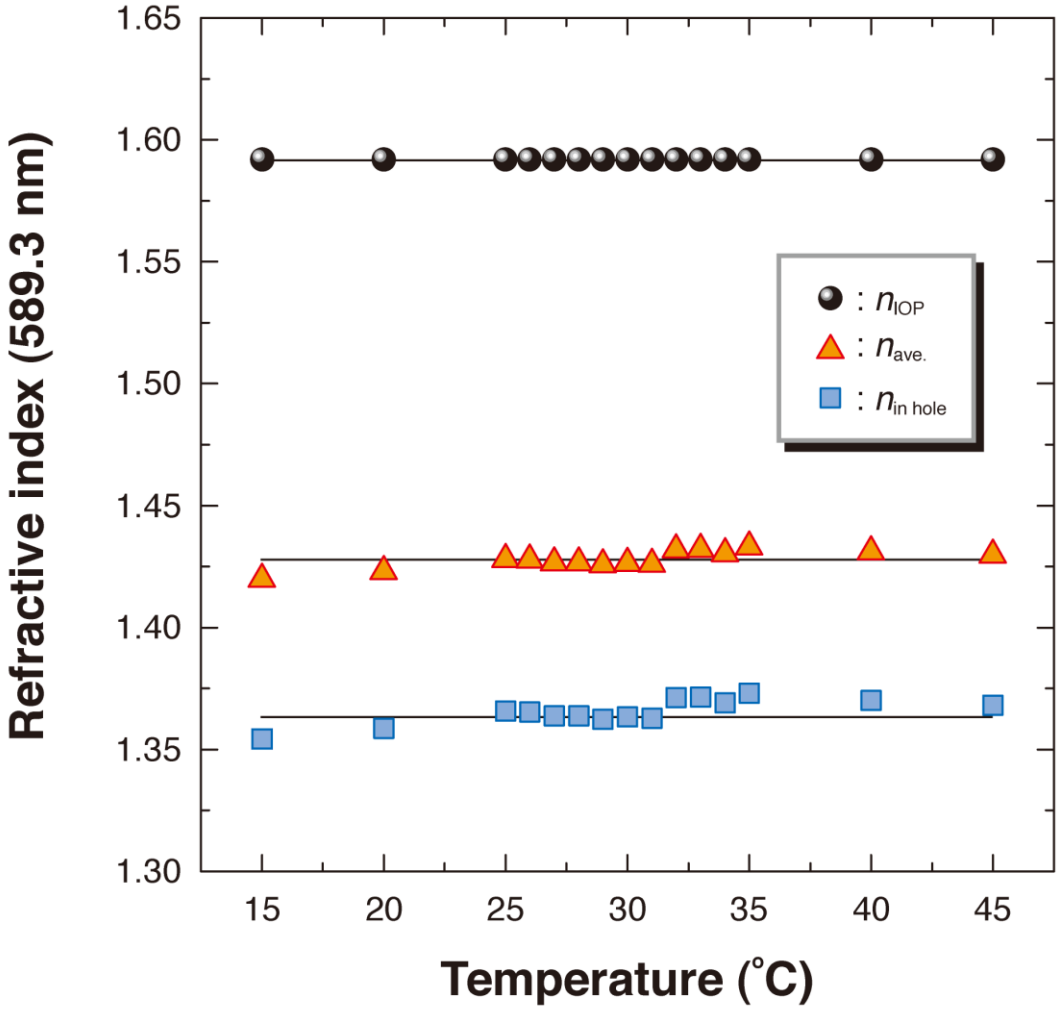


S2. Swelling ratio of D_0

a) Swollen state b) Collapsed state



S3a. Refractive indices of *N*-isopropylacrylamide gel and water, depending on temperature.



S3b. Refractive indices of IOP (●), the porous portion including water and *N*-isopropylacrylamide gel particles in GIP (■), and the average refractive index of GIP (▲), depending on temperature.