

# Supporting Information

## Swelling of Gel-Immobilized Colloidal Photonic Crystals in Ionic Liquids

Toshimitsu Kanai,<sup>\*,†</sup> Seiji Yamamoto,<sup>†</sup> and Tsutomu Sawada<sup>‡</sup>

<sup>†</sup>Yokohama National University, 79-5 Tokiwadai, Hodogaya, Yokohama, Kanagawa

240-8501, Japan, and <sup>‡</sup>National Institute for Materials Science, 1-1 Namiki, Tsukuba, Ibaraki  
305-0044, Japan

### Experimental procedure

We used a suspension of uniform silica colloidal particles (Nippon Shokubai Co., Ltd., KE-W20; particle diameter: 210 nm; CV: 7%) or polystyrene particles (Thermo Fisher Scientific; particle diameter: 198 nm; CV: 5%). The suspension was deionized in vials by using mixed-bed ion-exchange resin (Bio-Rad, AG501-X8) until the suspension showed iridescence indicative of a crystal phase. This colloidal crystal was mixed with aqueous solutions of *N*-methylol-acrylamide (N-MAM) as a monomer, *N,N'*-methylene-bis-acrylamide (BIS) as a cross-linker, and 2,2'-azobis[2-methyl-*N*-(2-hydroxyethyl)propionamide] (VA) as a photo-induced polymerization initiator for ultraviolet (UV) light. The reaction solution (particle volume fraction: approximately 10%; N-MAM: 600 mM; BIS: 40 mM; VA: 0.5 mM) was bubbled with Ar gas for 10 min to remove dissolved O<sub>2</sub> and CO<sub>2</sub>; it was then injected into a flat capillary cell (internal dimensions: 0.1 mm thick, 9 mm wide, 50 mm long) made of glass, and processed with a momentary strong shear flow to obtain a single-crystal-like domain extending throughout the capillary. The obtained flow-aligned

particle arrays were immobilized by the photo-polymerization of the gelation reagents in a UV-light exposure chamber (Edmund Optics Inc., output power: 26 mW/cm<sup>2</sup> at 365 nm) for 30 min. Thus, we obtained a self-standing gel film containing the loosely packed colloidal crystals; the film was cut into circular fragments with a diameter of 3 mm. The fragments were soaked in the ionic liquid for a few days to replace water in the gel with the ionic liquid.

Table S1: Properties of gel-immobilized polystyrene colloidal crystal films soaked in various ionic liquids. The initial particle volume fraction is about 10%.

Ionic liquid		Degree of swelling	Particle volume fraction (%)
1-Butyl-3-methylimidazolium acetate	Hydrophilic	1.06	11 ± 3
1-Ethyl-3-methylimidazolium acetate	Hydrophilic	0.99	14 ± 4
1-Hexyl-3-methylimidazolium chloride	Hydrophilic	1.01	13 ± 4
1-Methyl-3-octylimidazolium chloride	Hydrophilic	0.92	17 ± 5
1-Ethyl-3-methylimidazolium dicyanamide	Hydrophilic	0.95	16 ± 4
1-Butyl-3-methylimidazolium thiocyanate	Hydrophilic	0.82	25 ± 7
1-Ethyl-3-methylimidazolium bis(trifluoromethyl sulfonyl)imide	Hydrophobic	<0.6	>62
Trihexyltetradecylphosphonium chloride	Hydrophobic	<0.6	>62
Trihexyltetradecylphosphonium dicyanamide	Hydrophobic	<0.6	>62