



Supporting Information

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Foam Films Obtained with Ionic Liquid

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1. Materials

Brij-35 and 1-ethyl-3-methylimidazolium tetrafluoroborate (EMIBF_4) were purchased from *Kanto Chemical* and used without further purification. 1-Ethyl-3-methylimidazolium thiocyanate (EMISCN) and 1-ethyl-3-methylimidazolium trifluoromethylsulfonate ($\text{EMICF}_3\text{SO}_3$) were obtained from *Fluka* and *Merck*. Brij-78, Brij-700, and Pluronic F127 were purchased from *Acros Organics*, *Aldrich*, and *Wako Chemicals*, respectively. Copper grids in sizes of 2000- to 50-mesh were obtained from *Oken-shoji*.

2. Microscopic observations

Scanning electron microscope (SEM) images were obtained by using a *Hitachi* S-4800. To prevent electric charging, a 2-nm thick platinum layer was deposited on the specimen by using a *Hitachi* E-1030 ion sputter. This deposition was conducted at room temperature under an argon atmosphere of 10 Pa or lower and at a current density of 10 mA. The thickness of platinum layer was calibrated by means of quartz crystal microbalance technique. For the cross-sectional observation, an 18-nm thick platinum layer was deposited on the both sides of Newton black films formed in a 1000-mesh copper grid. The grid was carefully ripped off to form the cutting surface, and set on a vertical sample holder. In the above conditions, platinum nanoparticles of about 0.8 nm uniformly deposit on the surfaces of any kind of Newton black films without disrupting the morphology. Transmission electron microscope (TEM) images were obtained by using a *JEOL* JEM-2100F at an acceleration voltage of 200 kV. The measurements were conducted without platinum deposition. AFM measurements were performed on a *Seiko* SPI-4000 microscope in a tapping mode, using a silicon nitride cantilever (DNP-S20 from *Veeco*) with a nominal spring constant of 0.06 N/m at a resonance frequency of 114 kHz. Optical microscopy images were obtained using an instrument, *Lasertec* VL2000D.

3. Raman measurements

A confocal Raman spectrum of a Newton black film of Brij-35 is shown in Figure S1. The spectrum was obtained on a *Horiba* Jobin-Yvon T6400. The strong peaks at 765, 1024, and 1453 cm^{-1} were attributed to EMIBF_4 . This clearly indicates that the Newton black films contain EMIBF_4 .

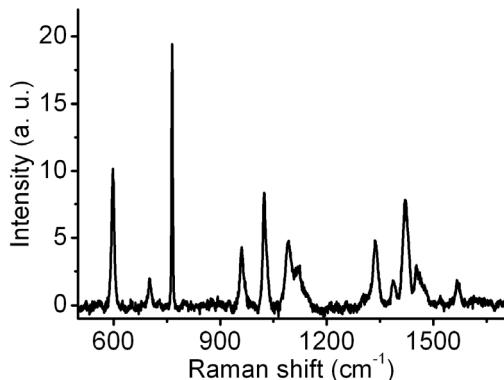


Figure S1. Raman spectrum of Newton black film of Brij-35.

4. XPS measurements

X-ray photoelectron spectroscopy (XPS) analysis was carried out using a *Physical Electronics Quantera SXM*, in which the specimen was irradiated with a monochromatic Al K α X-ray focused in a spot size of 10 μm . The atomic composition was calculated from the spectra obtained from the central part of a Newton black film formed in a 1000-mesh copper grid.

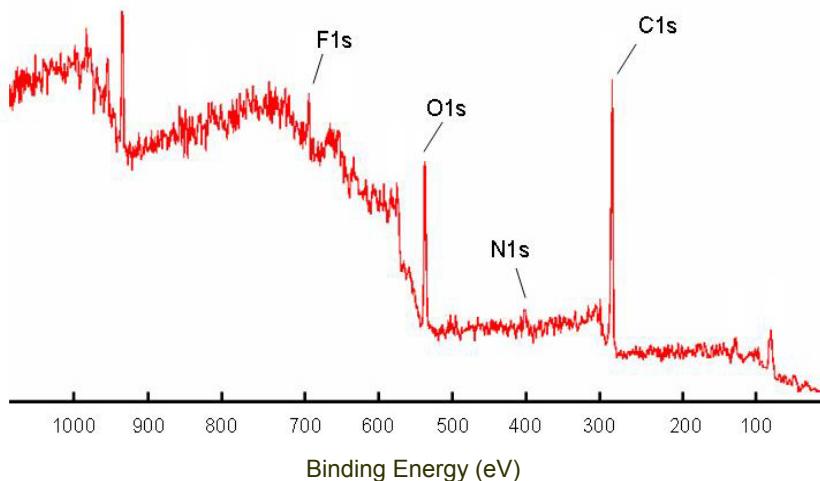


Figure S2. XPS spectrum of Newton black film of Brij-35.

5. DSC measurements

Newton black films of Brij-35 showed the thermal stability up to 180 °C. We examined the endothermic properties of Brij-35 and the composites with EMIBF₄ in the temperature range of -50 °C to 250 °C by differential scanning calorimetry (DSC). The thermograms were obtained on a *SII Nanotechnology EXSTAR 6000* with a measurement range of ± 100 mW. Pure EMIBF₄ showed two weak and very broad peaks near 16 °C and 210 °C. The former peak corresponds to the melting point of EMIBF₄. The EMIBF₄/Brij-35 composite at the molar ratio of 3/1 gave two endothermic peaks near 5 °C and at 35.8 °C. When the ratio was 1/1, the latter peak shifted to 38.2 °C, which was more close to the endothermic peak of pure Brij-35. For the 3/1 composite (red curve), a broad peak appeared at 195 °C. This peak might be related to the thermal stability of the Newton black films.

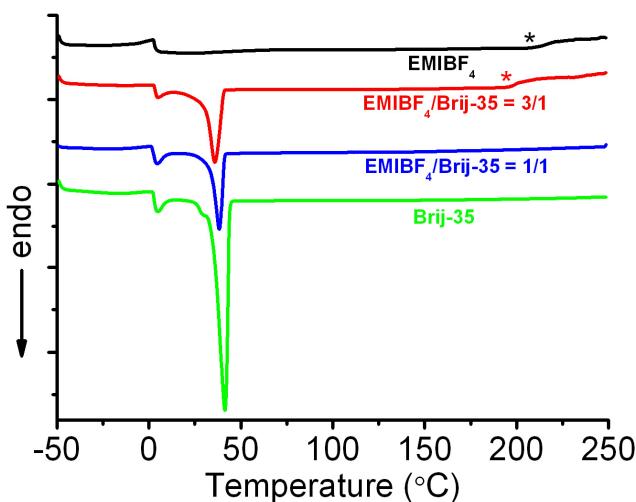


Figure S3. DSC curves of EMIBF₄, Brij-35, and their composites. The molar ratios are 1/1 and 3/1 for EMIBF₄ against Brij-35. The curves were obtained at the second heating.