

Electronic Supplementary Information

Transparent and visible-light harvesting acridone-bridged mesostructured organosilica film

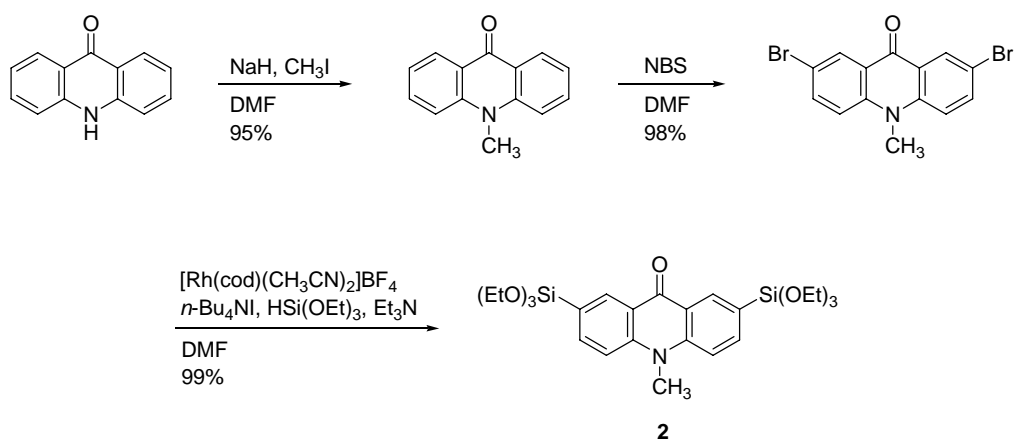
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1. Synthesis of precursor 2

The precursor **2** was synthesized according to the synthetic route shown in Scheme S1. Fig. S1 and S2 show the NMR spectra of the precursor **2**.



Scheme S1. Synthetic route of the precursor **2**.

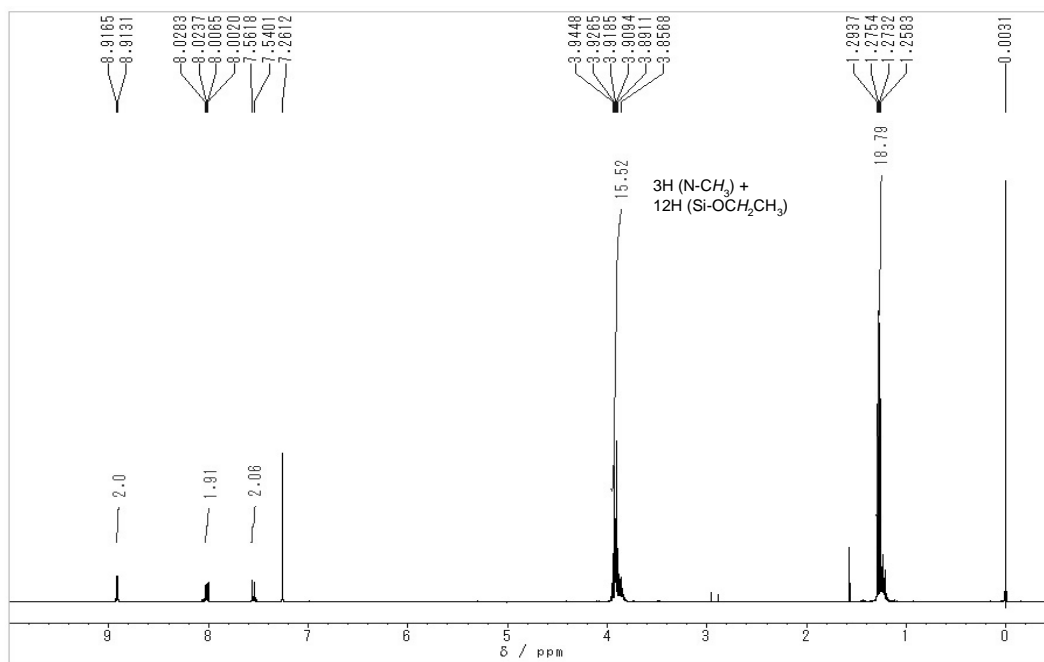


Fig. S1 ^1H NMR spectrum of the precursor **2** in CDCl_3 .

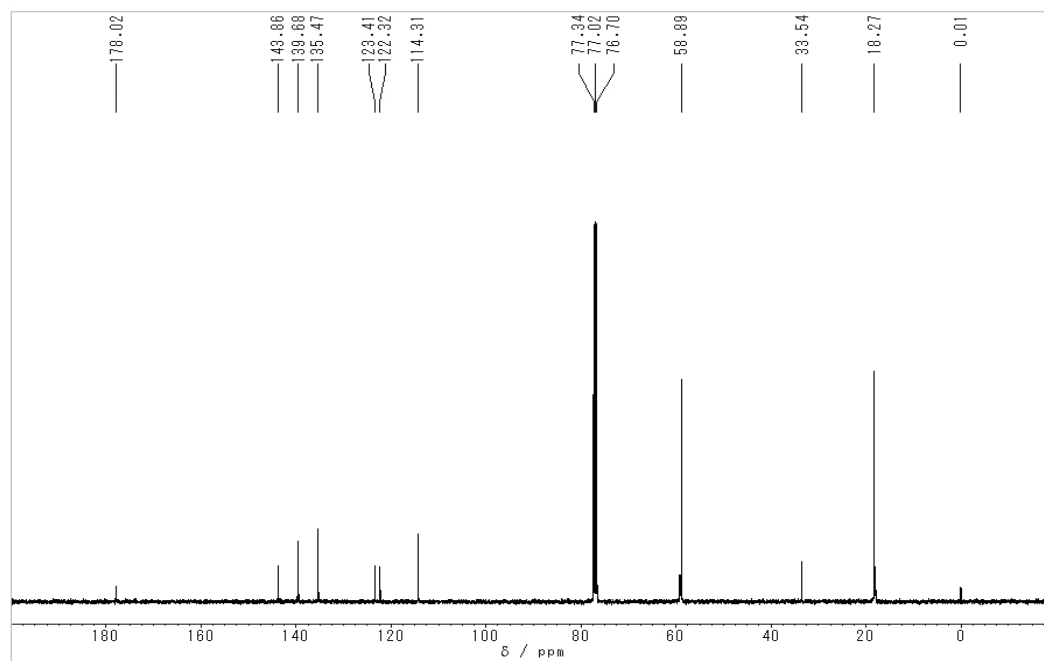


Fig. S2 ^{13}C NMR spectrum of the precursor **2** in CDCl_3 .

2. Infrared absorption spectrum of the precursor 1

An infrared absorption (IR) measurement was carried out to evaluate the bonding state of the N-H and C=O units in the precursor **1**. The IR band due to the stretching mode of hydrogen-bonded N-H and C=O units is clearly indicated at 3260 cm^{-1} and 1621 cm^{-1} , respectively.

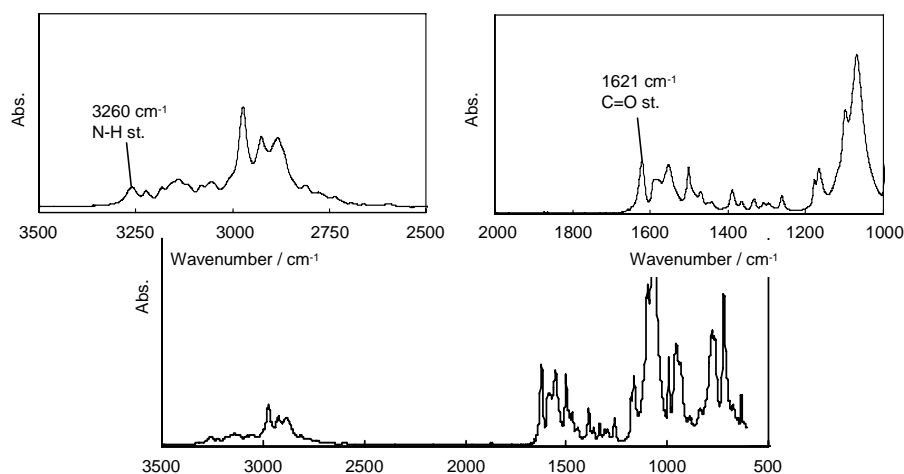


Fig. S3 Infrared absorption spectrum of the precursor **1** and details of the spectrum at $2500\text{--}3500\text{ cm}^{-1}$ and $1000\text{--}2000\text{ cm}^{-1}$

4. UV-vis absorption spectra of sol solution 1 before and after filtration

The amount of **1** dissolved in the sol solution before and after filtration was examined by UV-vis absorption. The measurement was carried out for the sol solution after thousand-fold dilution with 2-propanol. The absorbance at 398 nm due to **1** decreased by <7% by filtration, which indicates that >93% of **1** was still remained in the sol solution after filtration.

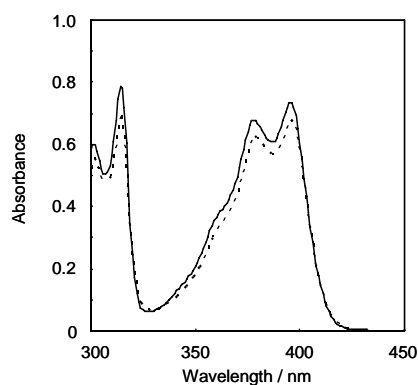


Fig. S4 UV-vis absorption spectra of the sol solution of **1** before (solid lines) and after (broken lines) filtration.

5. Optical micrograph of F-2 after extraction of the surfactant

An optical microscopy observation was carried out for **F-2** after extraction of the surfactant (Fig. S5). **F-2** mostly retained its transparency without cracking even after the extraction, although the surface became slightly rough due to shrinkage by further condensation with exposure to NH_3 vapor prior to the extraction.

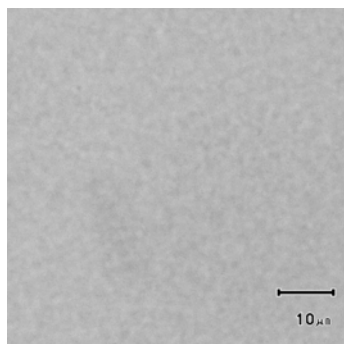


Fig. S5 Optical micrograph of **F-2** after extraction of the surfactant (scale bar represents 10 μm).

6. Confirmation of removal of P123

In order to remove template surfactant P123 from **F-2**, the film was washed with ethanol. The removal of P123 was confirmed by IR measurements (Fig. S6). Disappearance of the IR bands at $2850\text{--}2960\text{ cm}^{-1}$ corresponding to the C–H stretching modes of the alkyl chain of P123 confirms complete removal of P123 by the ethanol wash, while the band at 1639 cm^{-1} due to the carbonyl C=O stretching mode of the organic bridge is unchanged before and after extraction of P123.

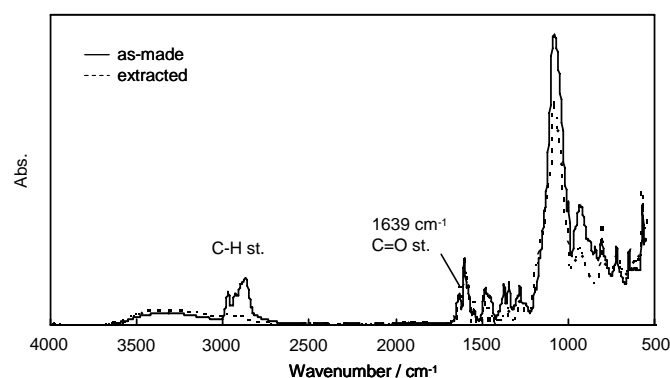


Fig. S6 Infrared absorption spectra of **F-2** before (solid line) and after (broken line) ethanol wash.

7. UV-vis absorption and fluorescence emission spectra of F-1 and aggregates of the precursor 1

Fig. S7 shows UV-vis absorption (a) and fluorescence emission spectra (b) of **F-1** and aggregates of the precursor **1** prepared by spin-coating of its ethanol solution. The UV-vis absorption and fluorescence emission spectra of **F-1** were primarily similar to that of the aggregates of the precursor **1**. This suggests that the conformation of most of the acridone groups in **F-1** is similar to that of the aggregates of the precursor **1**.

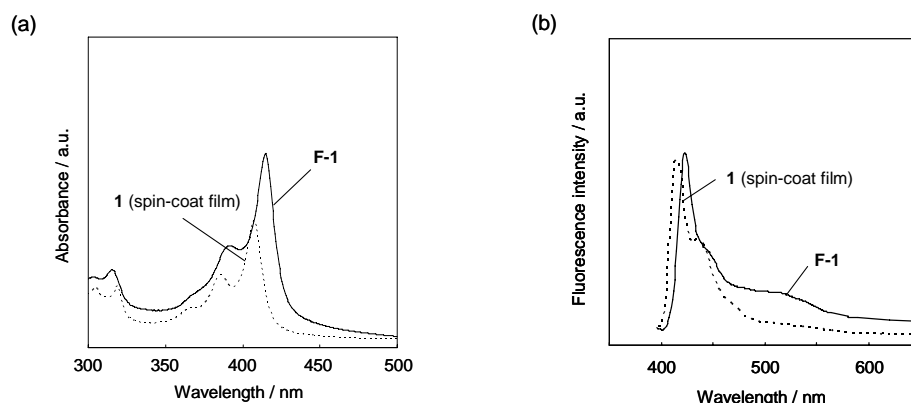


Fig. S7 (a) UV-vis absorption and (b) fluorescence emission spectra of **F-1** (solid lines) and aggregates of the precursor **1** (broken lines). The excitation wavelength is 380 nm for all samples.

8. Excitation spectra of F-1 and F-2

Fig. S8 shows excitation spectra of **F-1** and **F-2** at various wavelengths. The excitation spectrum of **F-1** at 450 nm was different from that at 520 nm. This result indicates that the fluorescence emission is originated from at least two components. The excitation spectrum of **F-1** at 450 nm showed a sharp peak attributable to the aggregates at 416 nm, whereas the excitation spectrum of **F-1** at 520 nm was similar to that of **F-2** at 500 nm. On the other hand, the excitation spectrum of **F-2** at 500 nm was primarily identical to its UV-vis absorption spectrum, which indicates that the fluorescence emission is originated from one component.

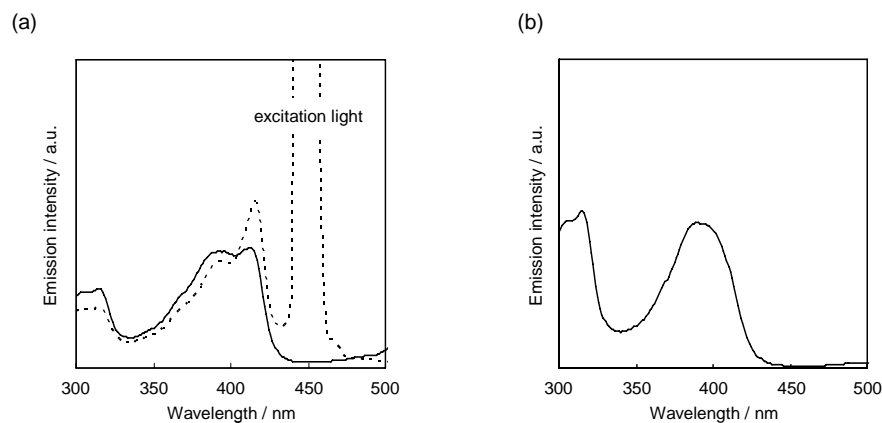


Fig. S8 (a) Excitation spectra of **F-1** at 450 nm (broken line) and at 520 nm (solid line) and (b) **F-2** at 500 nm.

9. Fluorescence quantum yields of F-2 before and after extraction of the surfactant

Fluorescence quantum yields of **F-2** were compared before and after extraction of the surfactant (Fig. S9). The extraction significantly decreased the fluorescence quantum yield of **F-2** possibly due to quenching by oxygen diffused into the mesochannels.

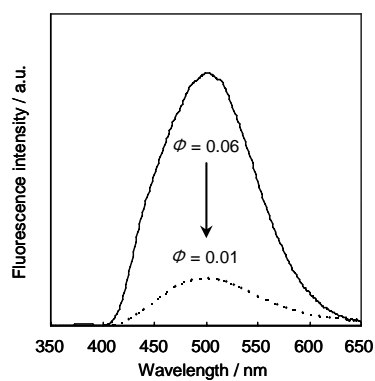


Fig. S9 Fluorescence emission spectra and quantum yields (ϕ) of **F-2** before (solid lines) and after (broken lines) extraction of the surfactant.