Supporting Information

Spontaneous Registration of Sub-10 Nanometer Features Based on Sub-Zero-Celsius Spin-Casting of Self-Assembling Building Blocks Directed by Chemically-Encoded Surfaces

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Table S1. Vapor pressure data of solvents depending on temperature

	Vapor pressure (mmHg)						
	@ -15℃	@ -5℃	@ 5℃	@ 15℃	@ 25℃	@ 35℃	@ 45℃
Heptane	4.0822	8.0520	14.958	26.372	44.406	71.799	111.98
Toluene	2.4747	4.9160	9.2137	16.408	27.935	45.693	72.122
PGMEA	0.19191	0.48902	1.1335	2.4230	4.8303	9.0628	16.126

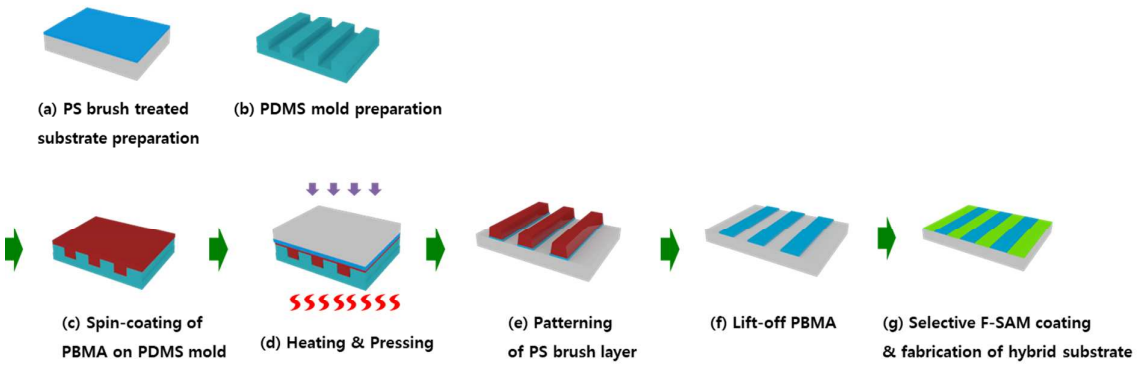

Figure S1. Process flow of SAM patterning *via* transfer printing and reactive ion etching.

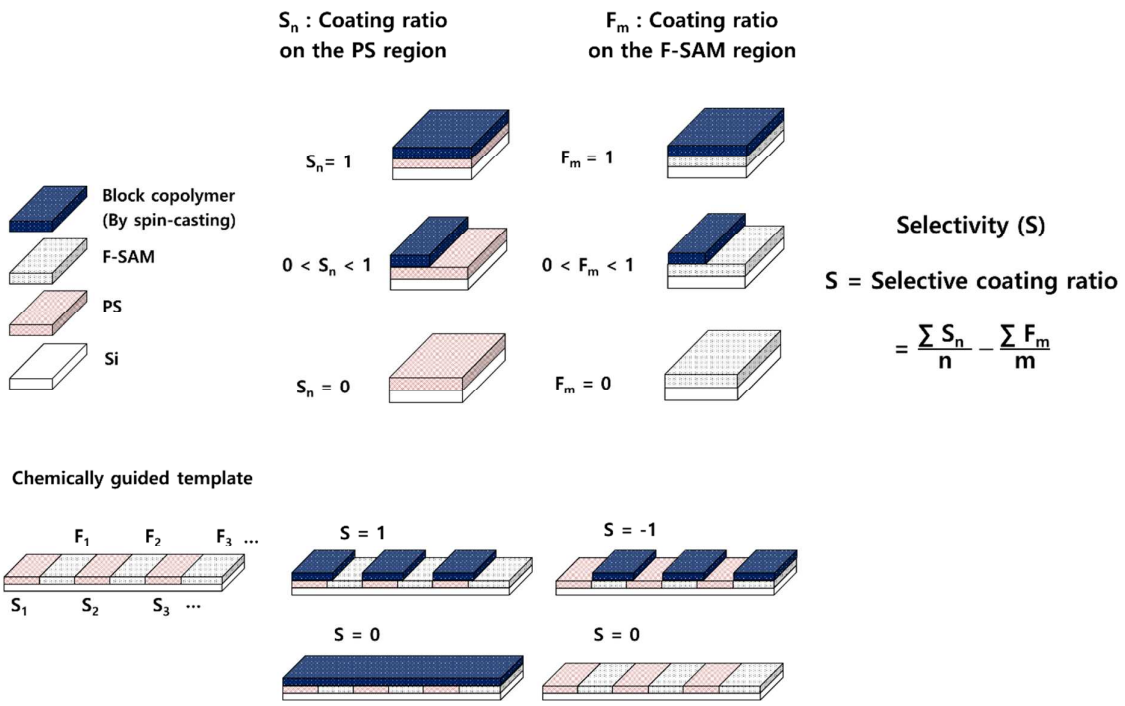

Figure S2. Definition of selectivity of spun-cast thin film on the patterned SAM substrate.

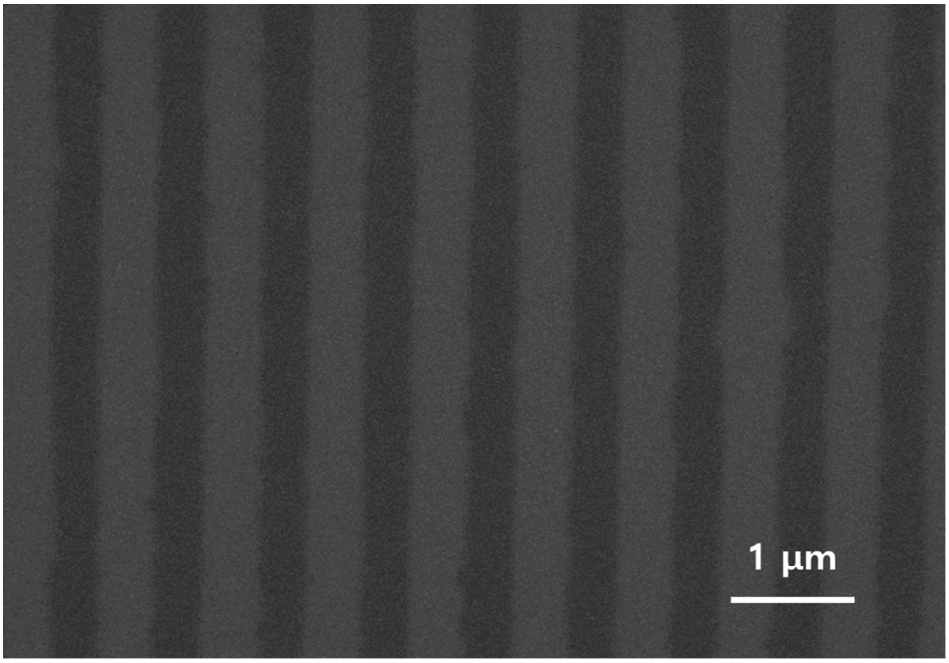

Figure S3. BCP thin films patterned with S-CSC at -5□.

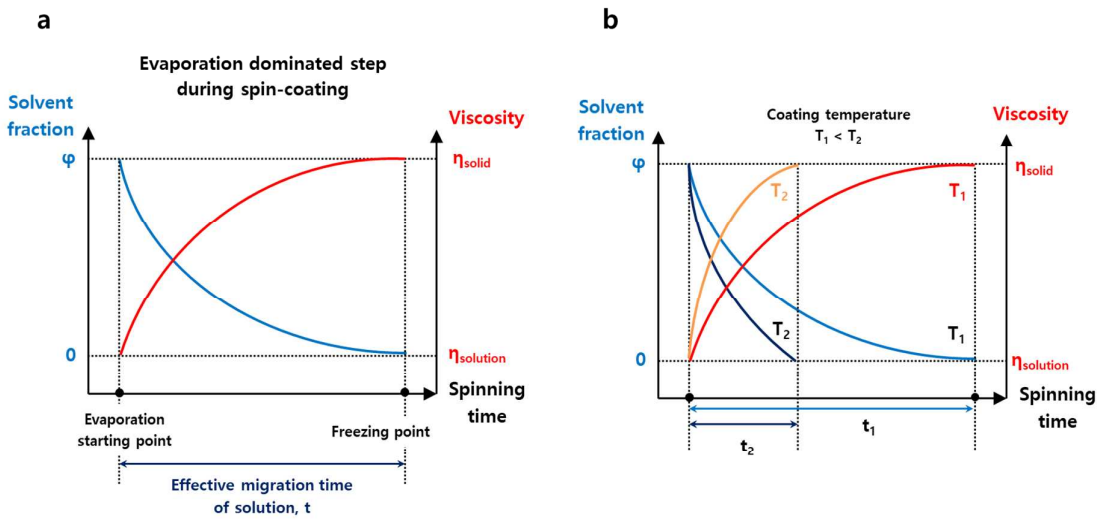

Figure S4. Illustration of effective migration time of solution depending on spin-casting temperature. (a) Effective migration time is defined as the time before the saturation of viscosity with evaporation of solvent during spin coating. (b) Lower spin-casting temperature allows a longer migration time.

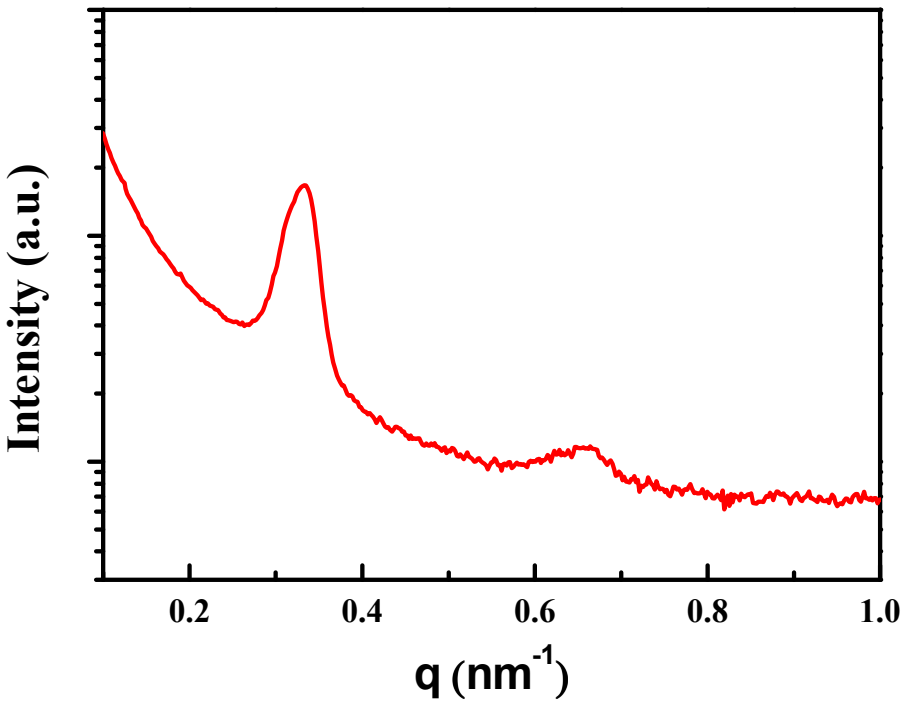

Figure S5. GISAXS data of the patterned BCP obtained with S-CSC at -5□.

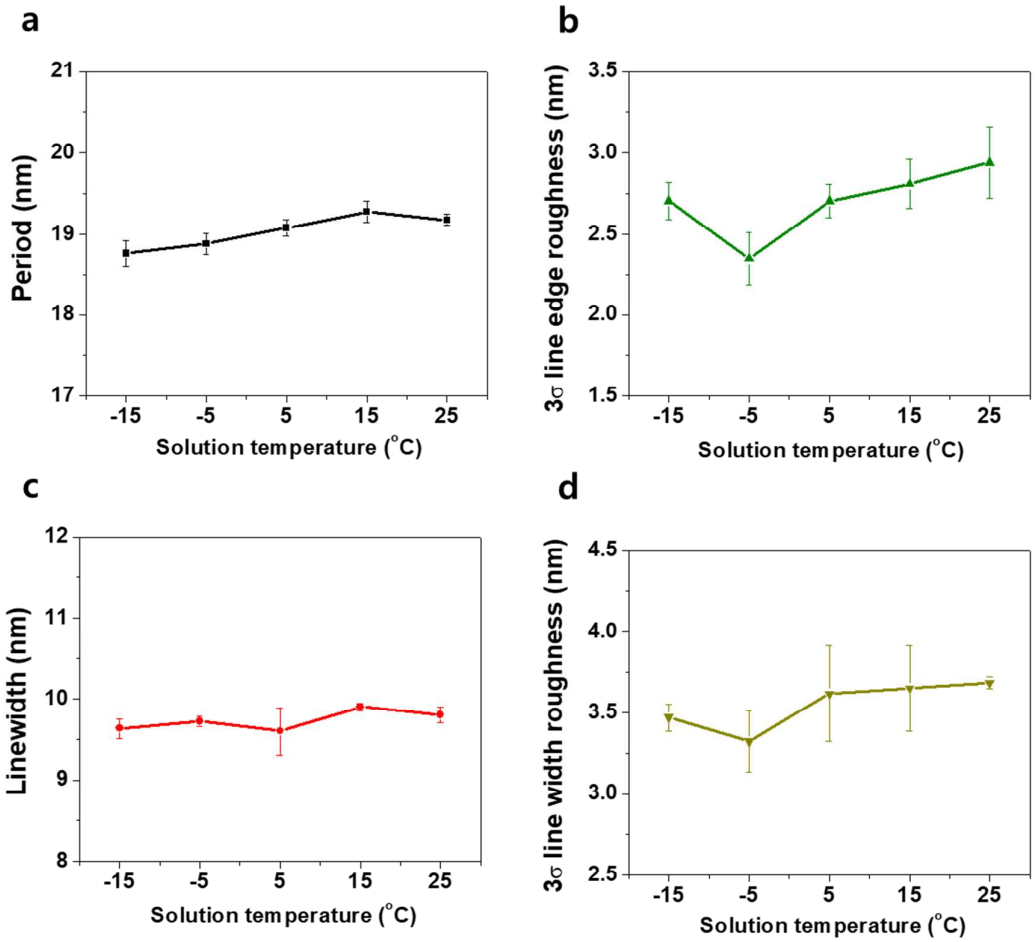

Figure S6. Pattern quality analysis of BCP patterns obtained from S-CSC, thermal annealing, and reactive ion etching.

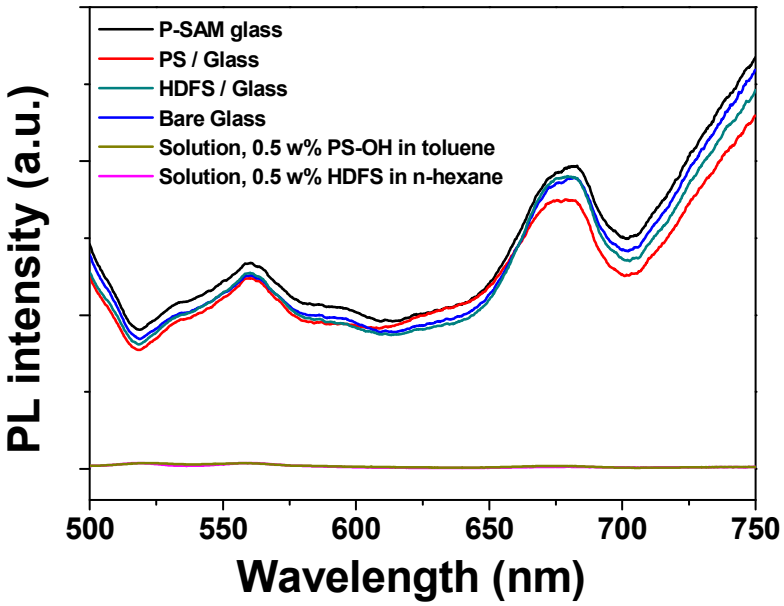

Figure S7. PL intensity profiles of the SAM patterns on glass substrate.

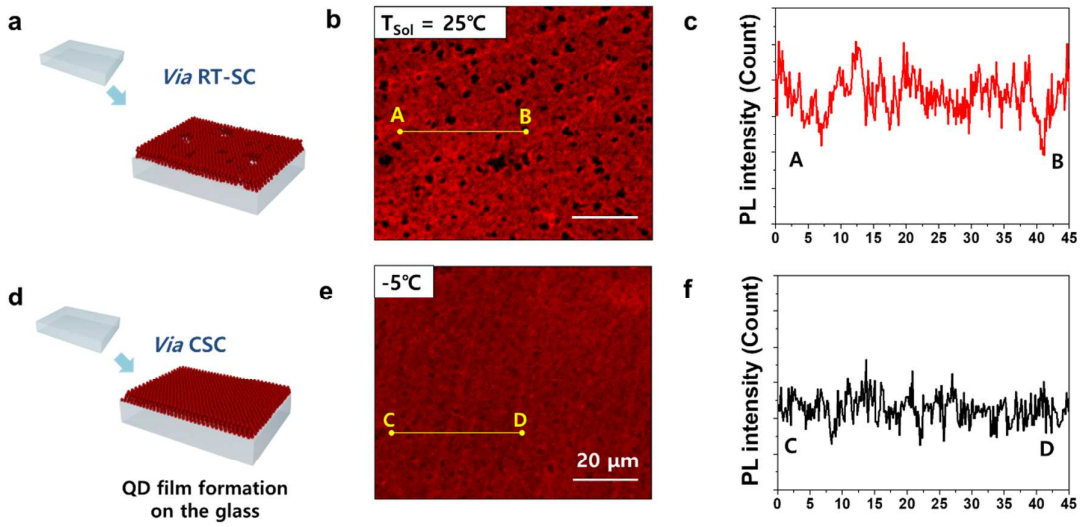

Figure S8. Fluorescence characteristics of CdSe QD on non-patterned glass substrate. (a), (b), and (c) RT cast at 25□ and (d), (e), and (f) CSC at -5□. (a) & (d) illustrations, (b) & (e) confocal microscopy images, and (c) & (f) emission intensity profiles.

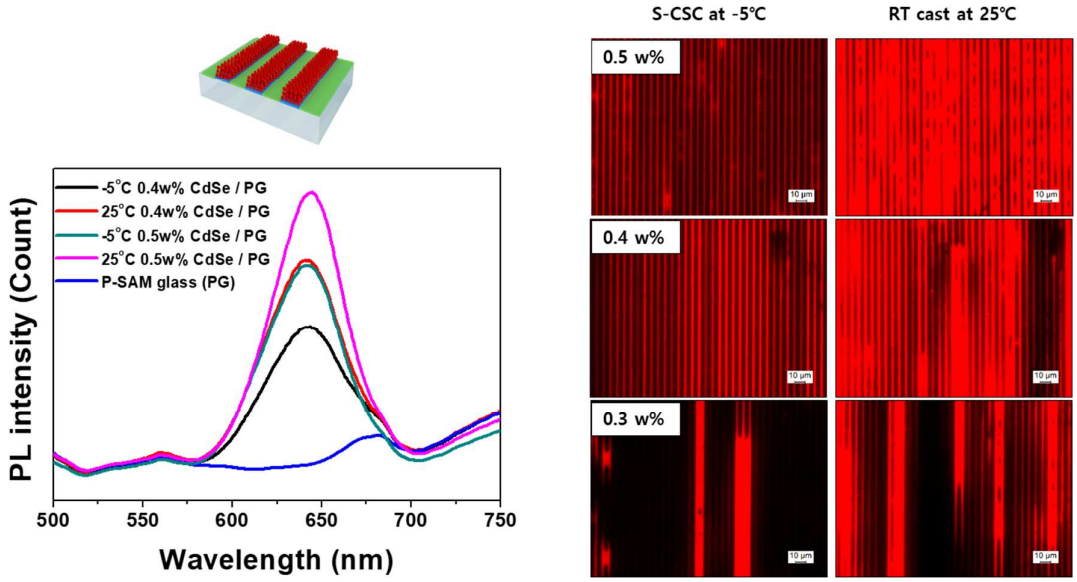

Figure S9. Fluorescence microscopy images and PL intensity of CdSe QD patterns depending on spin-casting temperature and QD concentration (from 0.5 to 0.3 w% in toluene).