Supplementary Information for

Development of a magnetic hybrid material capable of photoinduced phase separation of iron chloride by shape memory and photolithography.

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Effect of $FeCl_3$ in the TBPC hybrid system was investigated. Shape memory programming results obtained by DMA for hybrid films are shown in Figure S1, during application and release of 200 kPa stress (blue line), and under controlled temperature (red line). Vertical dashed lines indicate the strain under applied stress for shape fixing at 110 °C (ε_{110}), strain after removal of stress (ε_u), and strain after recovery (ε_{rec}). Shape-fixing ratio (Rf), and shape-recovery ratio (Rr) are the most employed performance indices for evaluating efficiency of shape memory properties.

Here, Rf is calculated by:

$$Rf = (\varepsilon_u/\varepsilon_{110}) \times 100\%, \quad (1)$$

Rr is calculated by:

$$Rr = [(\varepsilon_u - \varepsilon_{rec})/\varepsilon_u] \times 100\%, \quad (2)$$

where ε_{rec} is strain after recovery.

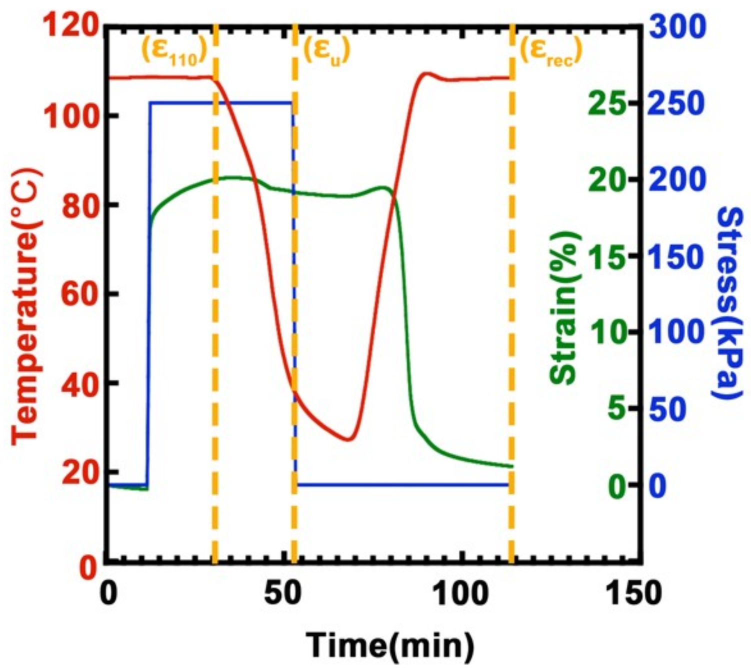

Figure S1. Shape memory programming results of Ti15TB40Fe5 hybrid film.

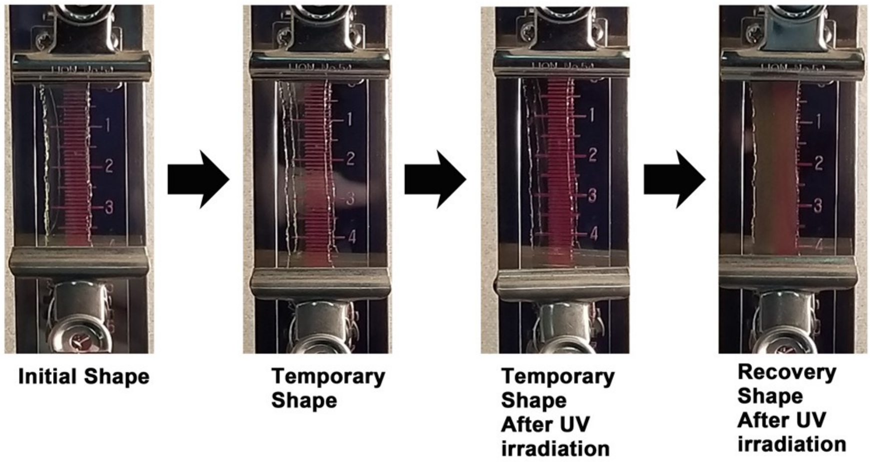

Figure S2. Images of shape memory process of Ti15TB40Fe5 with UV irradiation.

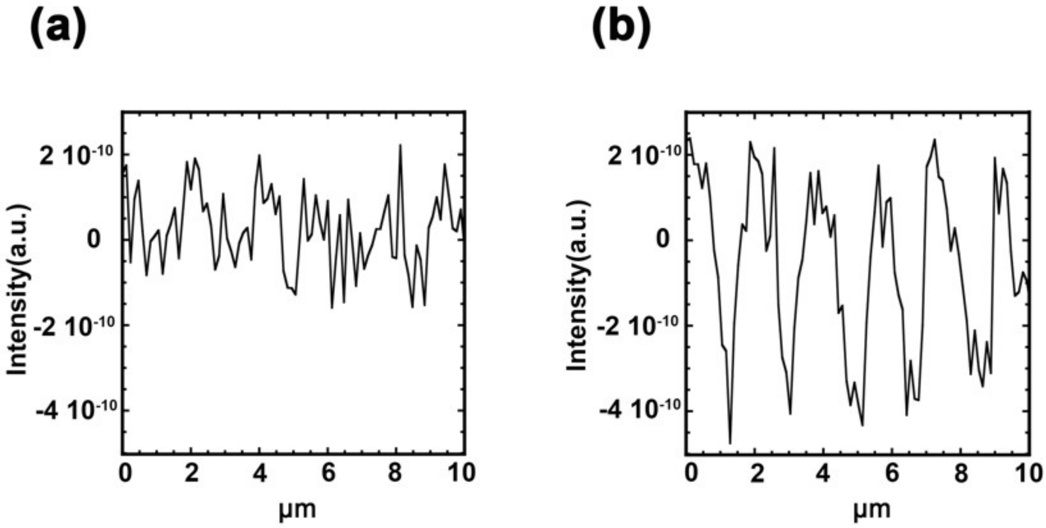

Figure S3. Line profiles of MFM intensity sampled by Figure 4 (c) and (d) for: (a) Hybrid film after UV irradiation. (b) Hybrid polymer after UV irradiation and shape recovery.

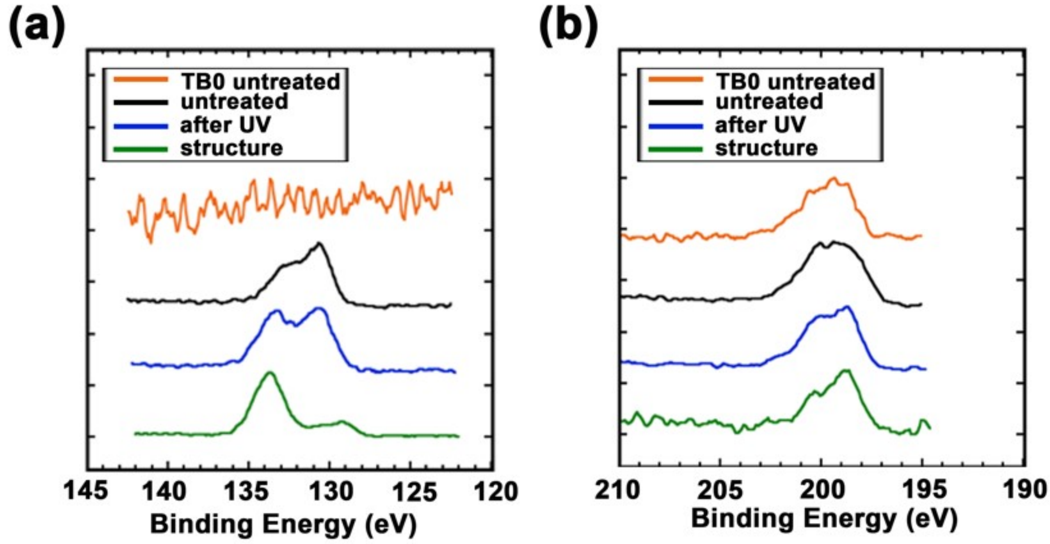

Figure S4. XPS spectra of Ti15TB0Fe5: untreated (orange line), and Ti15TB40Fe5: untreated (black line), after UV (blue line), and structure (green line), for: (a) P 2p (b) Cl 2p.

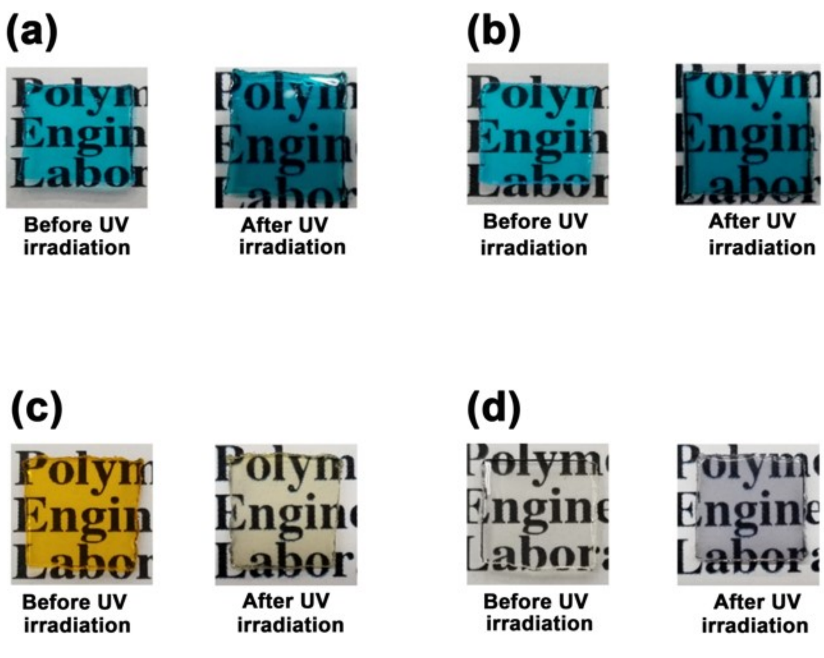

Figure S5. Photographs before and after UV irradiation for: (a) TB40Ti15Co5, (b) TB40Ti15Ni5, (c) TB40Ti15Cu5, and (d) TB40Ti15Zn5.

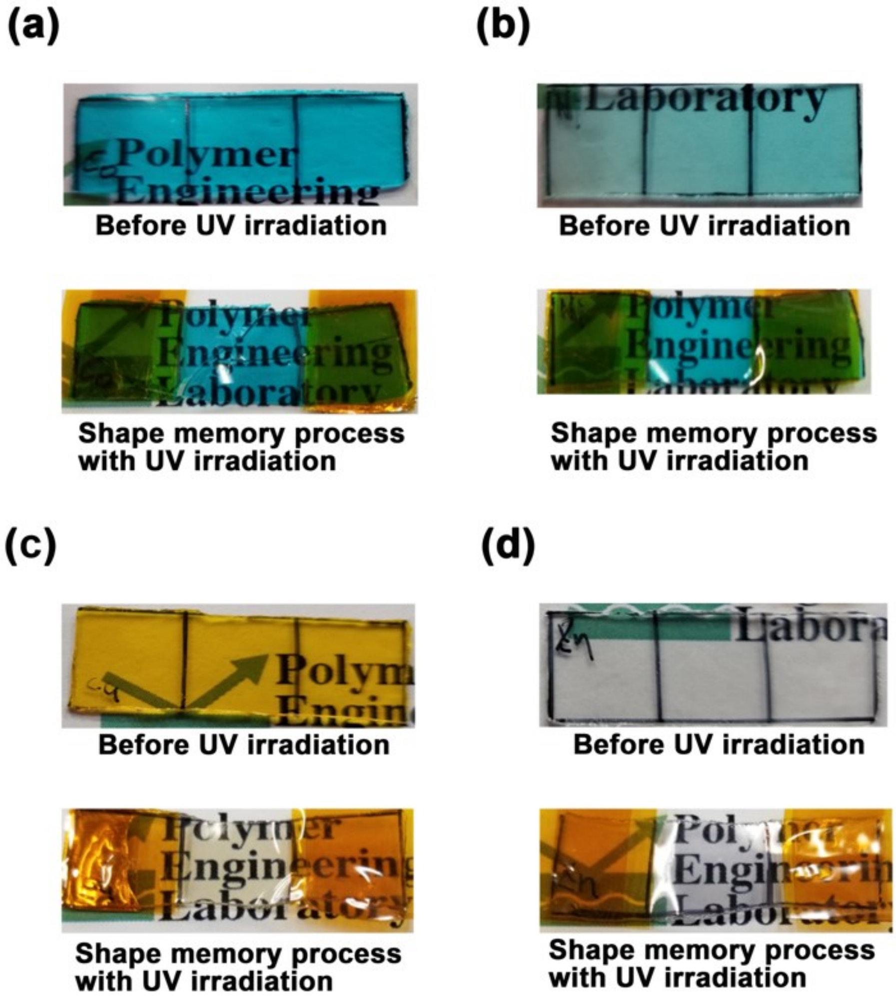

Figure S6. Photographs of shape memory process with UV irradiation: (a) TB40Ti15Co5, (b) TB40Ti15Ni5, (c) TB40Ti15Cu5, and (d) TB40Ti15Zn5.

Table S1. Tensile testing results, and glass-transition temperatures (Tg), obtained from DMA, for hybrid films with different TiOPr, TBPC, and $FeCl_3$ content.

Sample	Young modulus (GPa)	Brake energy (kJ/m3)	Tensile strength (MPa)	Storange E' at 25℃ (GPa)	Tg(DMA) (°C)
Ti15TB40Fe0	0.51	363.0	18.0	1.38	96.3
Ti15TB40Fe5	0.44	1480.0	19.9	1.44	89.7
Ti15TB40Fe10	0.49	662.0	20.4	2.18	92.8
Ti15TB40Fe15	0.50	375.8	17.5	2.65	93.8
Ti0TB40Fe5	0.29	370.3	12.7	1.20	80.5

Table S2. Shape memory programming results of Ti15TB40Fe5 hybrid film.

Sample name	Stress	ε_{100}	ε_{rec}	ε_u	Rf	Rr
	(kPa)	(%)	(%)	(%)	(%)	(%)
Ti15TB40Fe4	200	20	2.00	19	96	92