Electronic Supplementary Material (ESI) for Materials Horizons.

Supplementary Information

Fabricating Liquid Crystal Vitrimer Actuators far Below the Normal Processing Temperature

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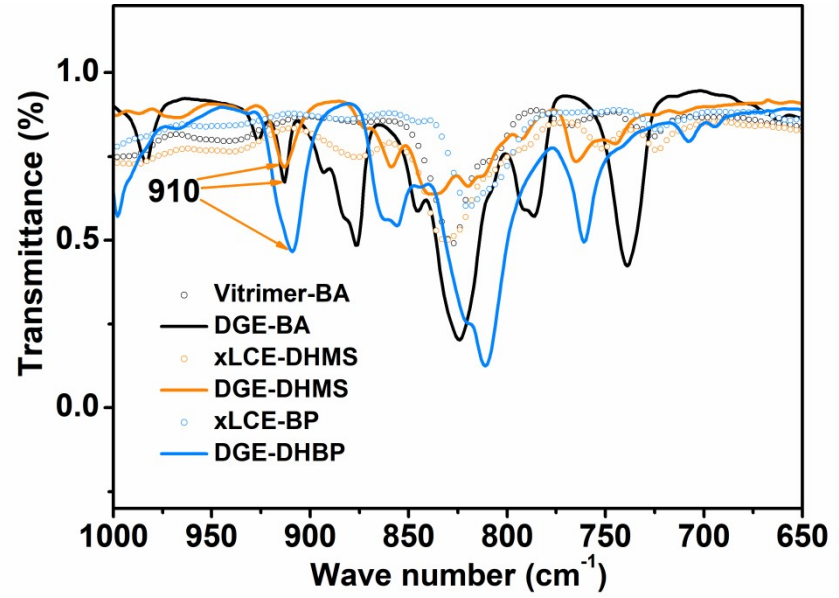
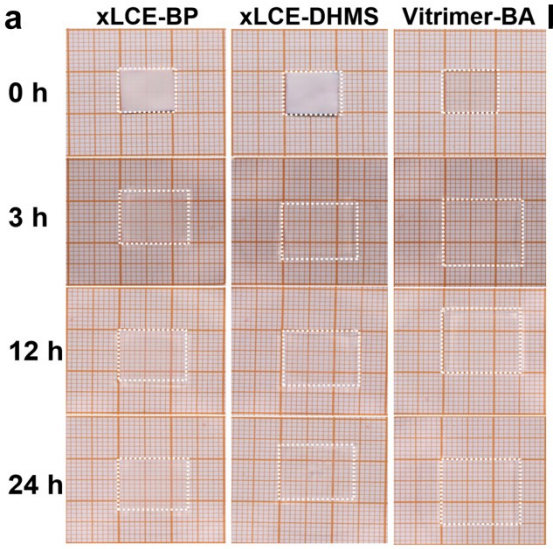


Fig. S1 Fourier transform infrared (FTIR) spectra of three monomers and vitrimers.

a



b

Sample	xLCE- BP	xLCE- DHMS	Vitrimer- BA
Volume change (cm*cm*mm) (i)			
V_0	1.00*1.00*0.17	1.00*1.00*0.31	1.00*1.00*0.26
V_1 (3 h)	1.25*1.30*0.23	1.30*1.40*0.39	1.50*1.50*0.34
V_2 (12 h)	1.25*1.30*0.23	1.30*1.40*0.39	1.50*1.50*0.34
V_3 (24 h)	1.25*1.30*0.23	1.30*1.40*0.39	1.50*1.50*0.34
V_3/V_0	2.20	2.29	2.94
Weight change (g) (ii)			
m_0	0.0210	0.0370	0.0333
m_1 (12 h)	0.0193	0.0361	0.0308
m_1 (24 h)	0.0195	0.0358	0.0305
m_3 (36 h)	0.0194	0.0361	0.0308
m_4 (48 h)	0.0193	0.0360	0.0308
Weight loss (%)	8%	2.7%	7.5%
Gel fraction (%)	92%	97%	93%

Fig. S2 Swelling and gel content tests. (a) Image of samples after swelling in anhydrous dichloromethane for different periods. (b) Volume change during swelling (including swelling ratio) and weight change during drying (including weight loss percentage and gel content calculation).

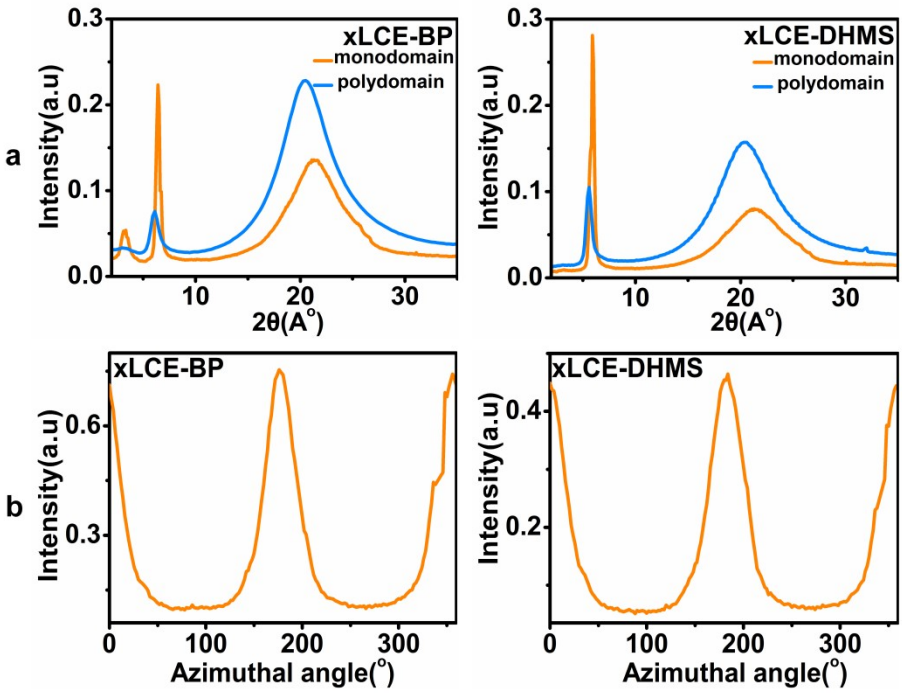


Fig. S3 (a) Integrated 1D X-ray scattering profiles of polydomain and monodomain xLCE-BP, azimuthal intensity scan of the X-ray diffraction pattern from the monodomain xLCE-BP. (b) Integrated 1D X-ray scattering profiles of polydomain and monodomain xLCE-DHMS, azimuthal intensity scan of the X-ray diffraction pattern from the monodomain xLCE-DHMS.

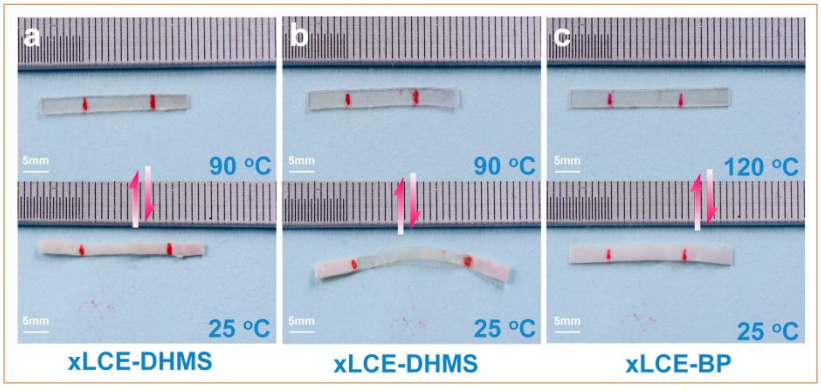


Fig. S4 (a) Reshaping xLCE-DHMS at 60 °C. (b) Reshaping xLCE-DHMS at 70 °C. (c) Reshaping xLCE-BP at 70 °C.

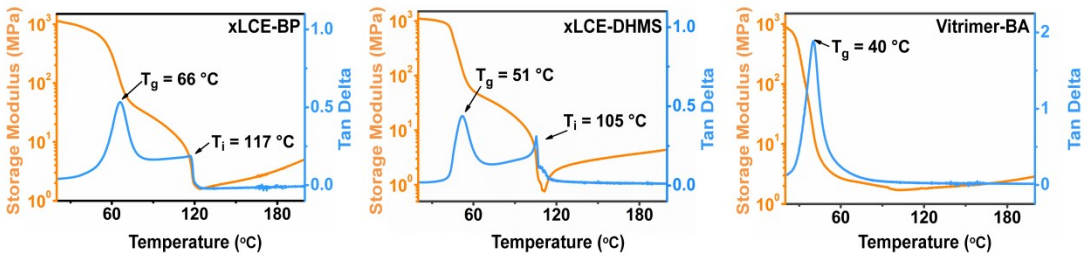


Fig. S5 Modulus-temperature curves of the vitrimers with 0.25 mol%TBD.

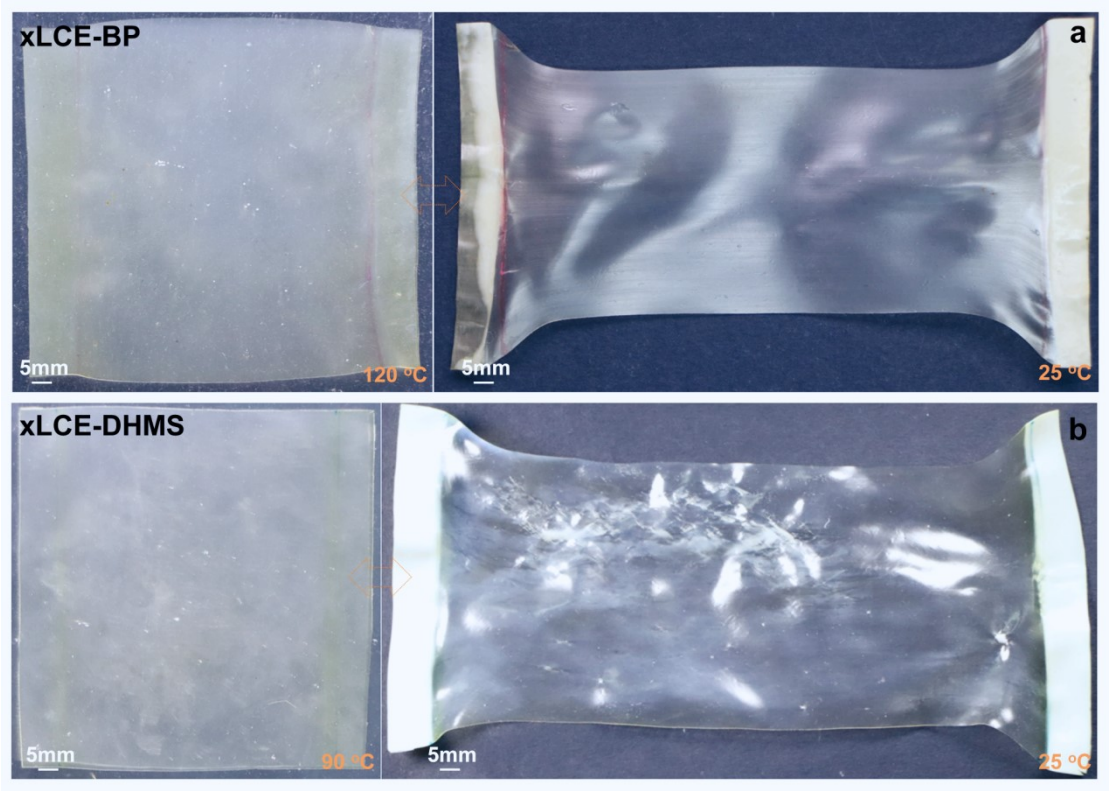


Fig. S6 The large size monodomain of xLCE-BP(a) and xLCE-DHMS(b).

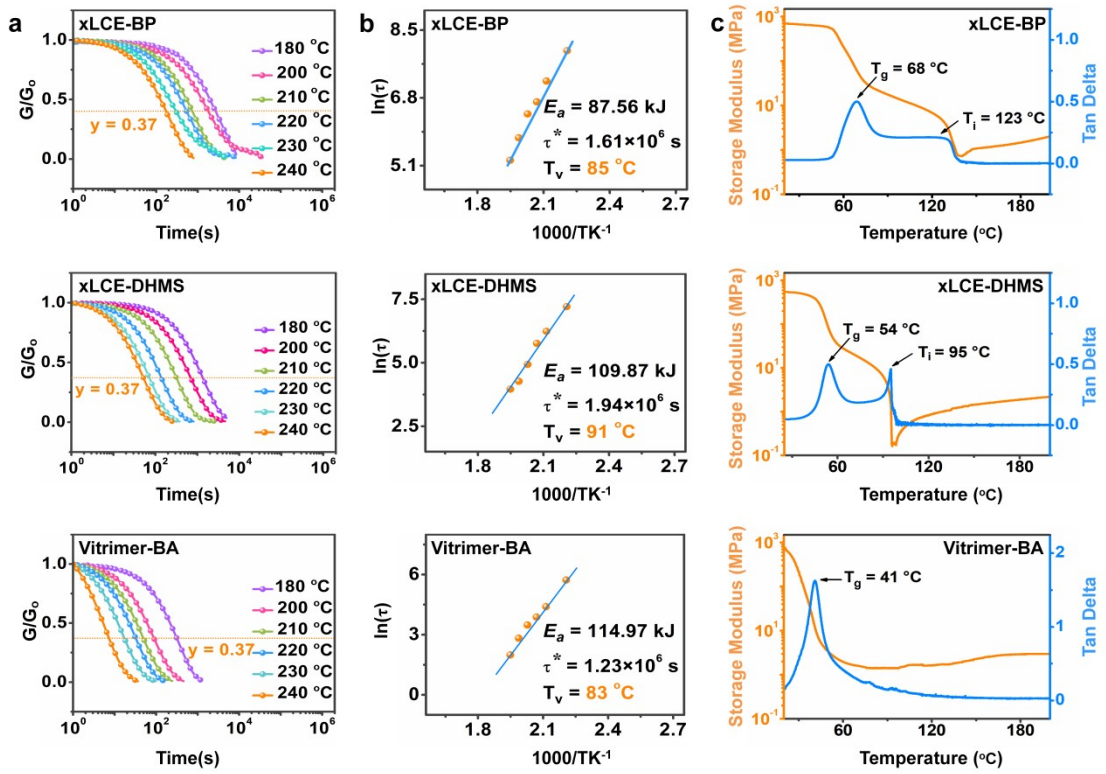


Fig. S7 (a) Modulus-temperature curves of the vitrimers with 5 mol%TBD. (b) Stress relaxation curves of the vitrimers with 5 mol%TBD at varying temperatures. (c) Arrhenius plot of the measured relaxation times for the vitrimers with 5 mol%TBD.

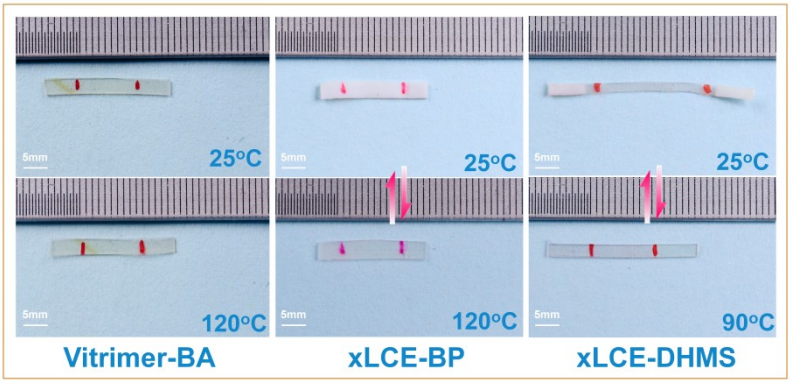


Fig. S8 Reshaping LC Vitrimers with 5 mol%TBD at 60°C.

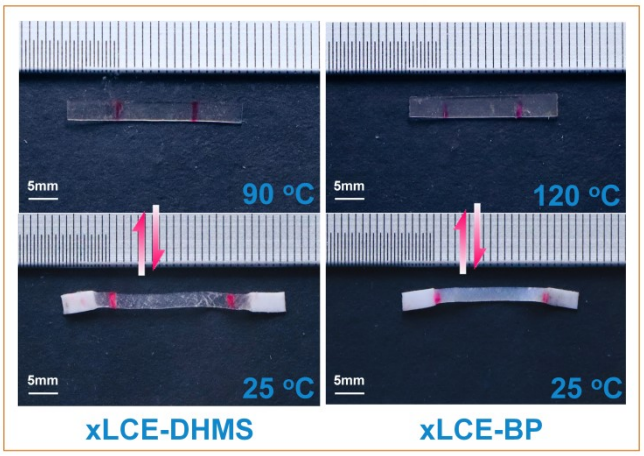


Fig. S9 Reshaping LC Vitrimers without catalyst at 80 °C.

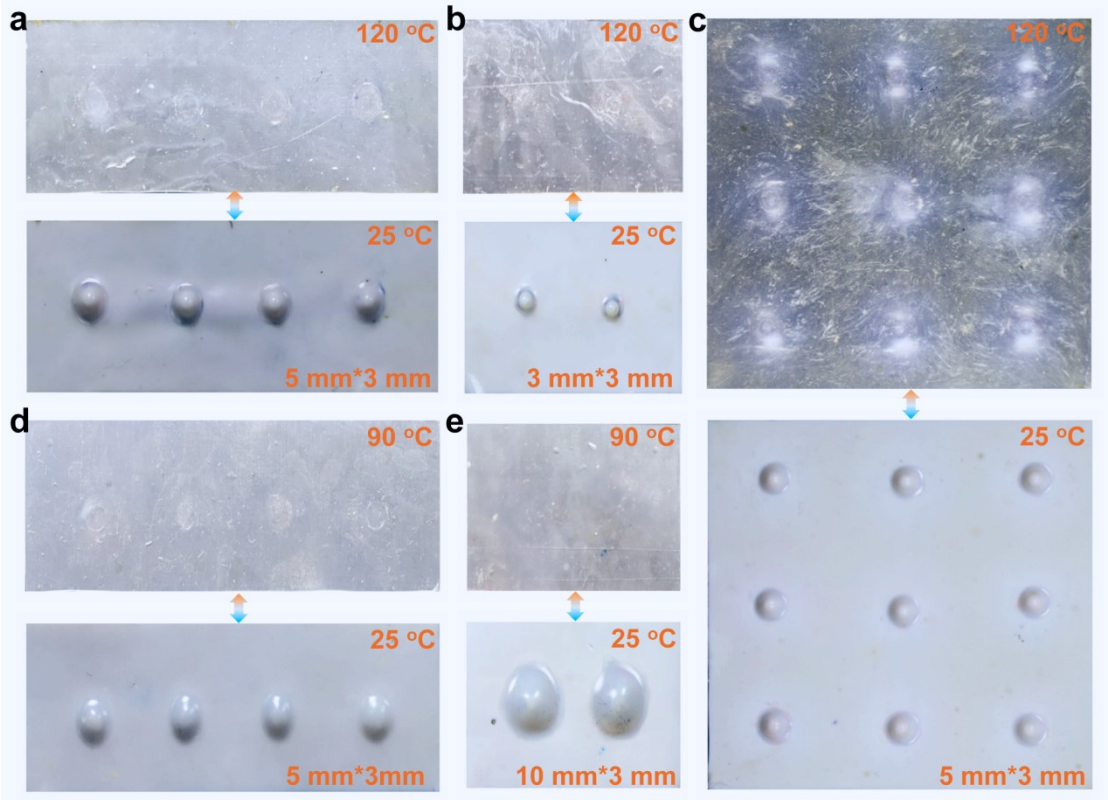


Fig. S10 xLCEs dome shapes with different diameters. The height of all domes is 3 mm. (a), (b), and (c) xLCE-BP dome shapes with diameter of 3 mm, 5 mm, and 5 mm respectively. (d) and (e) xLCE-DHMS dome shapes with diameter of 5 mm and 10 mm respectively.

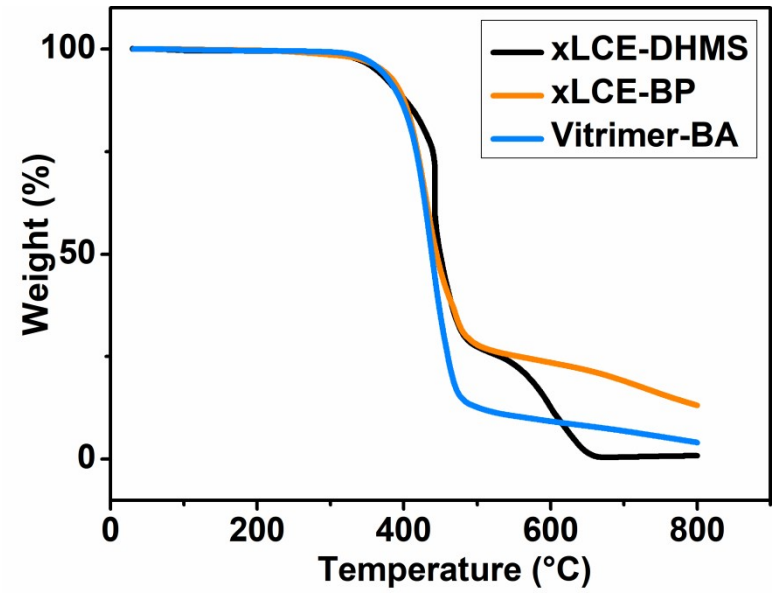


Fig. S11 TGA curves of vitrimers under nitrogen atmosphere.

Video S1 The video of the electrically driven dome arrays.