

Supporting Information

Energy Dissipation and Electromechanical Response in Dielectric Actuation of Liquid Crystal Elastomers

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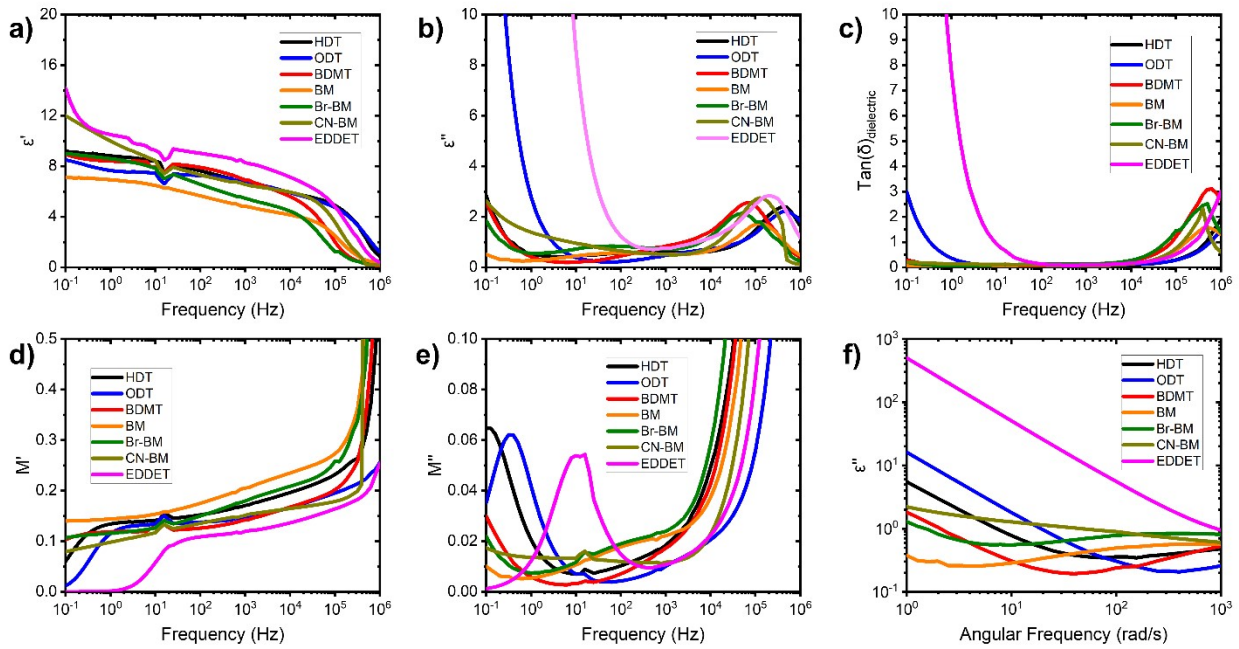


Figure S1. a) Real and b) imaginary relative permittivity and c) dielectric loss factor of LCEs as a function of frequency. d) Real and e) imaginary components of relative electric modulus of LCEs and the peak in M'' denotes the transition from Debye relaxation to ionic conduction. f) Log-log plot of ϵ'' vs. ω to analyze ionic conduction regime of permittivity.

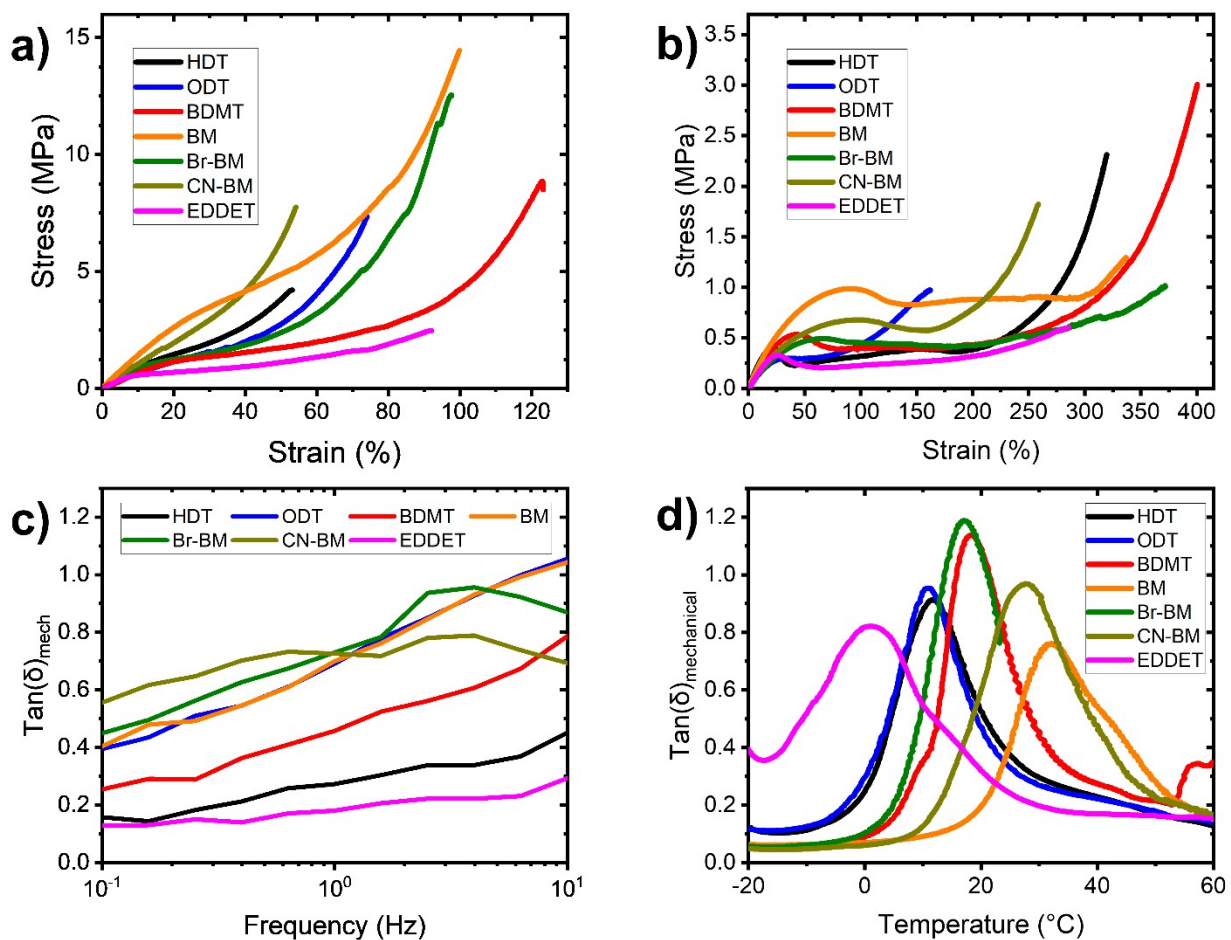


Figure S2. Uniaxial tensile response of LCEs a) parallel and b) perpendicular to the director.

Mechanical loss factor of LCEs measured perpendicular to the director as a function of c)

frequency and d) temperature.

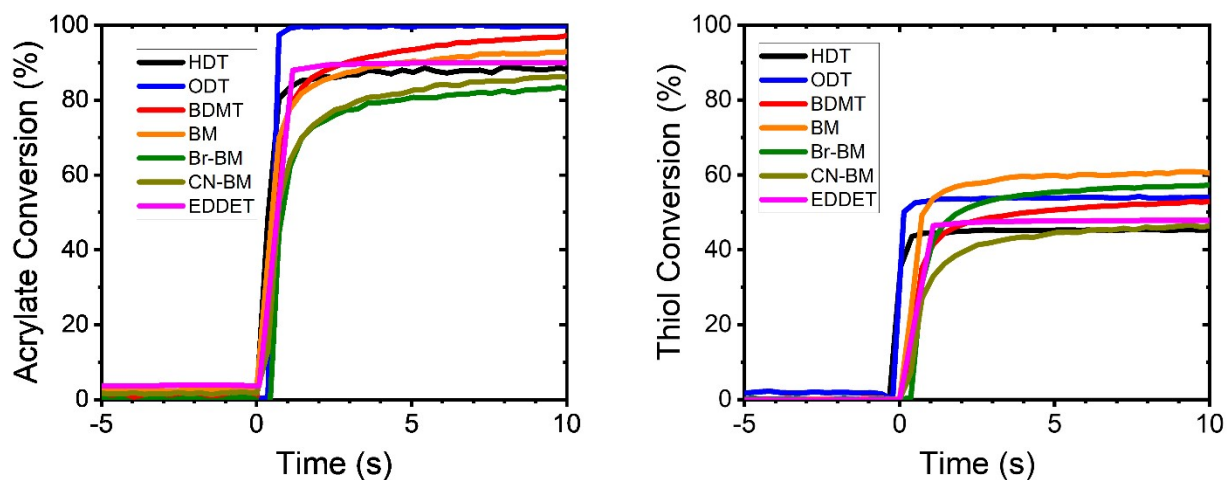


Figure S3. Acrylate and thiol conversion of LCEs measured via FTIR

LCE	Actuation Parameters			Relaxation Parameters		
	Strain @ t_{∞} (%)	Time scale (τ)	Stretching factor (α)	Fraction of strain @ t_{∞}	Time scale (τ)	Stretching factor (α)
HDT	5.46	132.8s	0.353	0	8.2s	0.405
ODT	4.27	104.8s	0.293	0	20.2s	0.393
BDMT	4.12	36.1s	0.455	0.23	4.5s	0.504
BM	1.37	45.5s	0.455	0.31	13.4s	0.666
Br-BM	7.16	1003.7s	0.595	0.32	47.4s	0.289
CN-BM	18.33	109.2s	0.513	0.14	12.4s	0.515

Figure S4. Parameters for theoretical long-term behavior of DLCEAs. Total actuation strain and the percentage of recoverable strain are captured by the first parameter. The characteristic time scale of viscoelastic deformation and recovery are captured by the second parameter, τ . The stretching factor, α , indicates how broad the distribution of time scales are distributed; as α approaches 1 there is a single characteristic time scale forming a true exponential distribution.