Electronic Supplementary Information

Bidirectional actuation of a thermoplastic polyurethane elastomer

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Volume conservation

The volume V of the PEU samples within the gauge length was estimated from length and width of a tensile trained specimen (data from tensile and dilatometric measurements). A constant specimen width was assumed.

$V = l \cdot t \cdot w$,

l_{HT} =61.6 mm, l_{LT} =65.0 mm

t_{HT} =1.91 mm, t_{LT} =1.82 mm

w = 2.98 mm

The high and low temperature volumes were V_{HT} = 0.351 cm^3 and V_{LT} = 0.353 cm^3, differing by 0.5%.

Figures

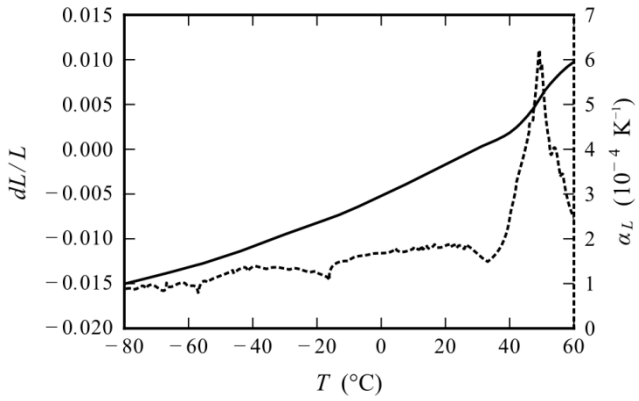

Fig. S1 Thermal expansion of untreated PEU as determined in dilatometric measurements. The sample expansion between –10 and 60 °C was 1.7%. The thermal expansion coefficients of PEU were α_1 = (1.7 ± 0.1) 10^{-4} K^{-1} in between –10 and 33 °C and α_2 = (3.4 ± 1.3) 10^{-4} K^{-1} in between 33 and 60 °C, respectively.

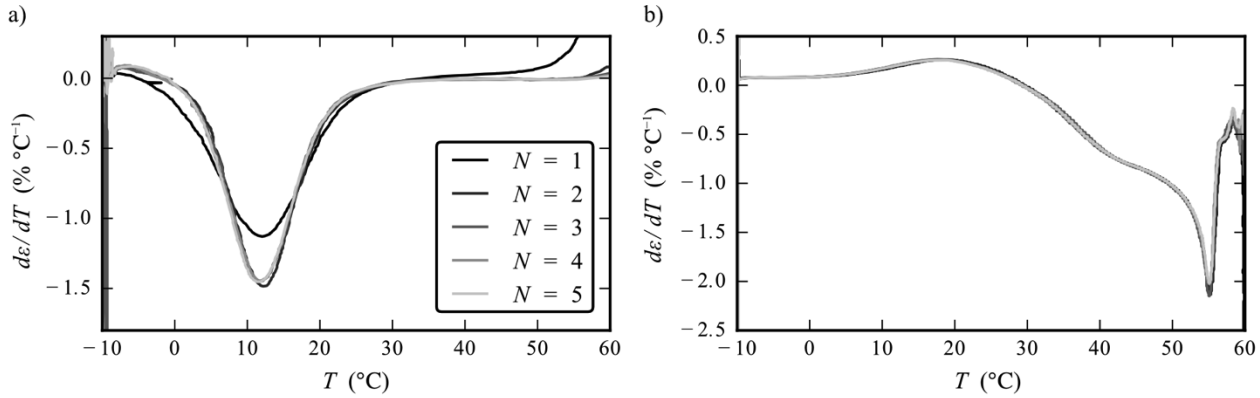

Fig. S2 Cooling- (a) and heating-related (b) strain-temperature derivatives of PEU actuation in N = 5 thermal cycles.

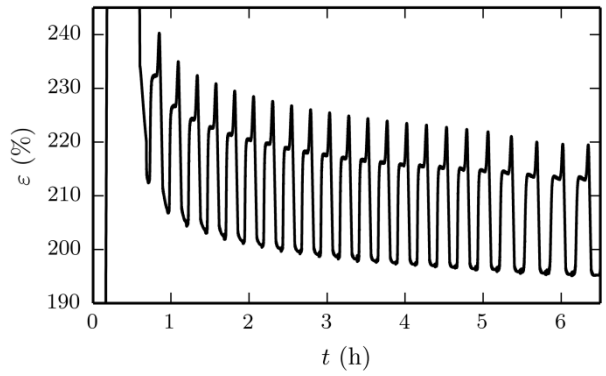

Fig. S3 Multiple cycle actuation of PEU. The evolution of strain ε is plotted above time t for a total number of 22 cooling-heating cycles.

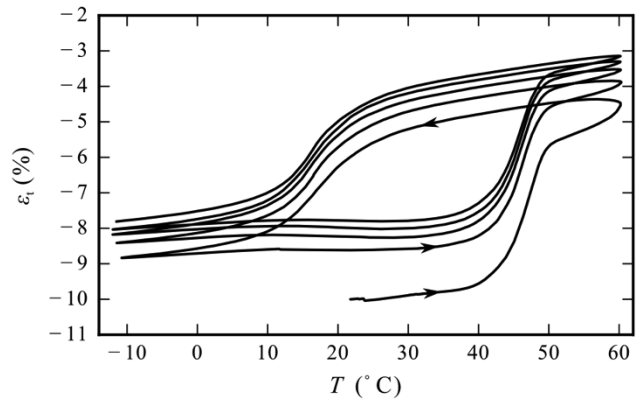

Fig. S4 Evolution in sample thickness ε_t upon temperature cycling of trained PEU during dilatometric measurements. According to the associated strain-temperature derivatives (not shown), sample thickness most drastically decreased at 17 ºC and increased at 46 ºC.

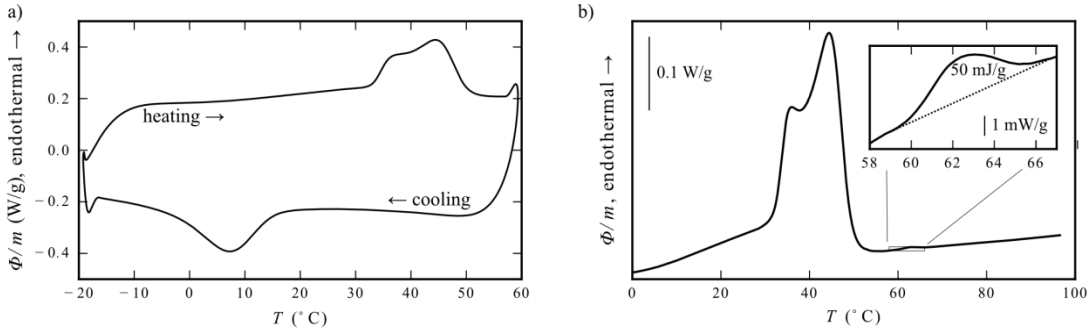

Fig. S5 DSC thermograms of trained PEU samples. a) First heating and cooling, covering the areas of PBA melting and crystallization. b) First heating up to 100 ºC, showing the melting of PBA crystallites, including those resulting from training (inset).