

Supporting Information

Towards textile metamaterials: A pathway to auxeticity and tensegrity in a needle-punched nonwoven stiff felt

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Differential Scanning Calorimetry (DSC)

DSC was performed on a Discovery DSC instrument by TA Instruments. About 10 mg stiff felt was cut and used with aluminum DSC pan. The instrument was programmed to (1) equilibrate at -30 °C, (2) stay isothermal for 5 mins, (3) heat at 10 °C/min to 200 °C, (4) stay isothermal for 5 mins, (5) cool at 10 °C/min to -30.00 °C, (6) stay isothermal for 5 mins and (7) heat again at 10 °C/min to 200 °C.

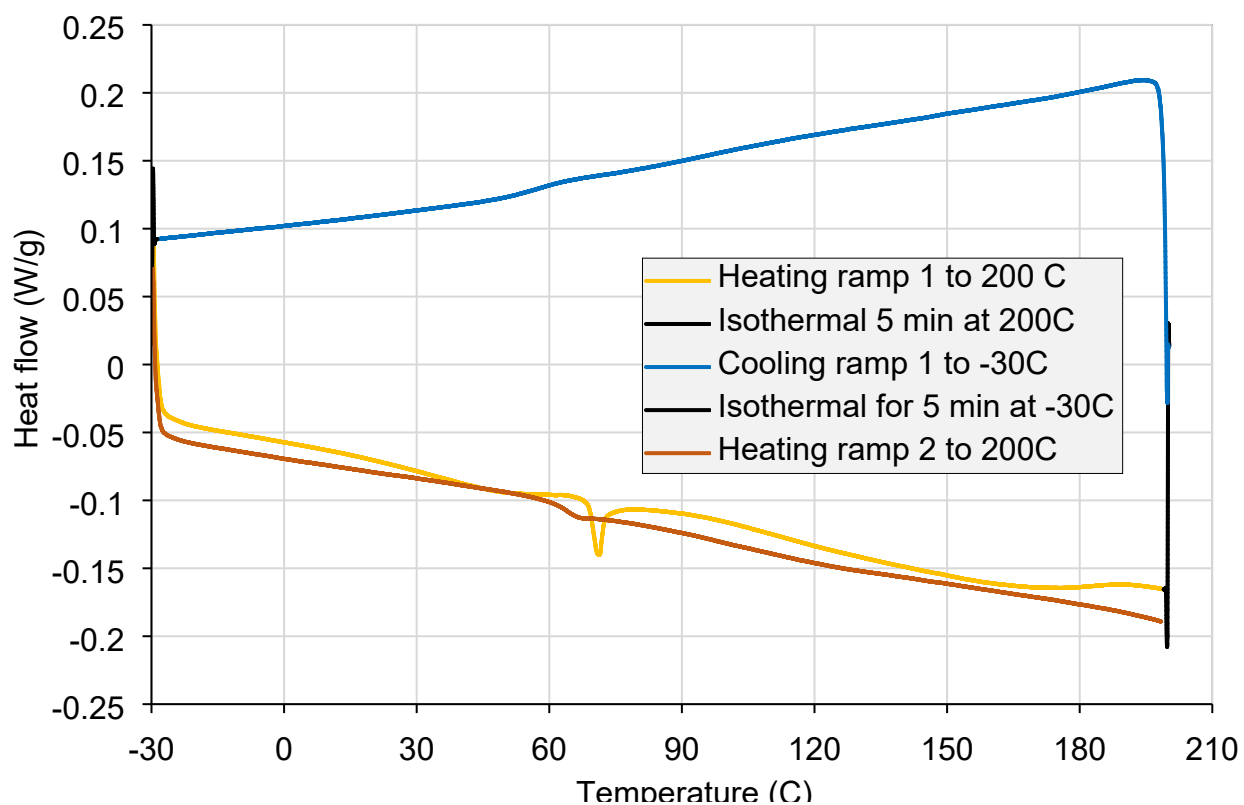
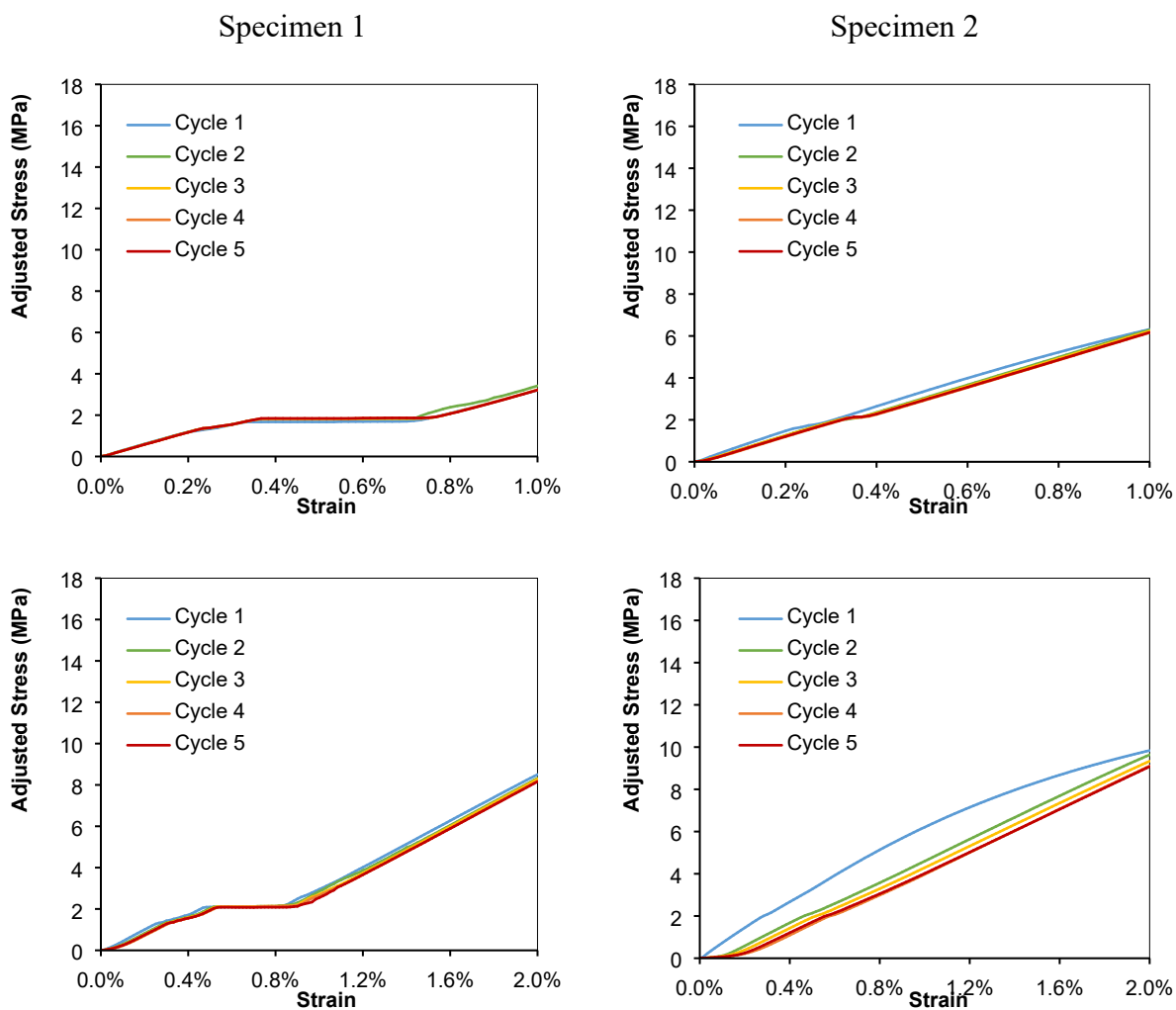
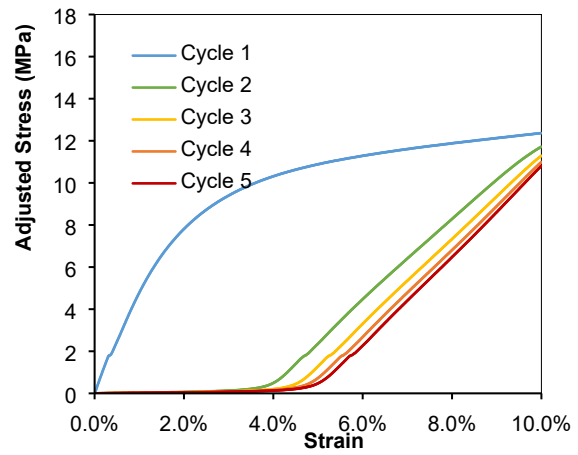
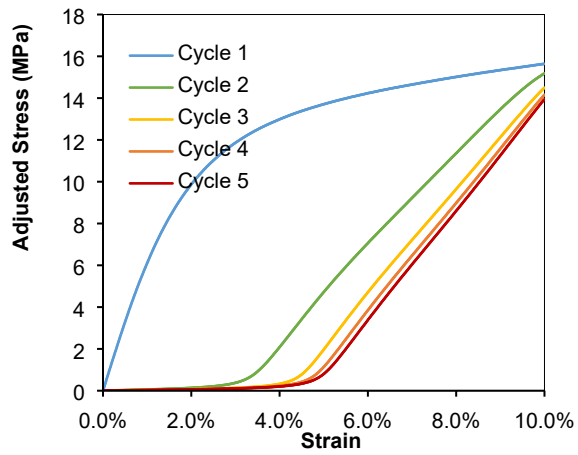
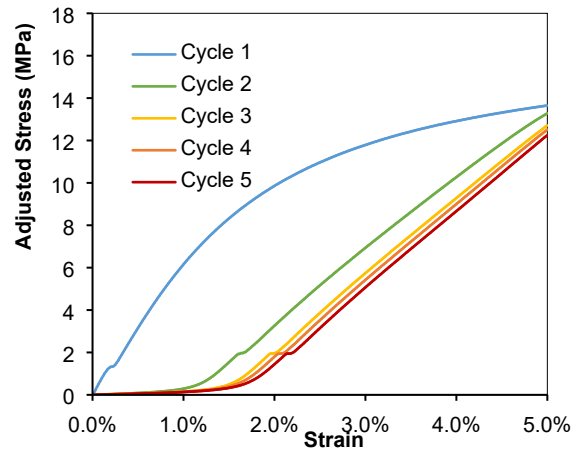
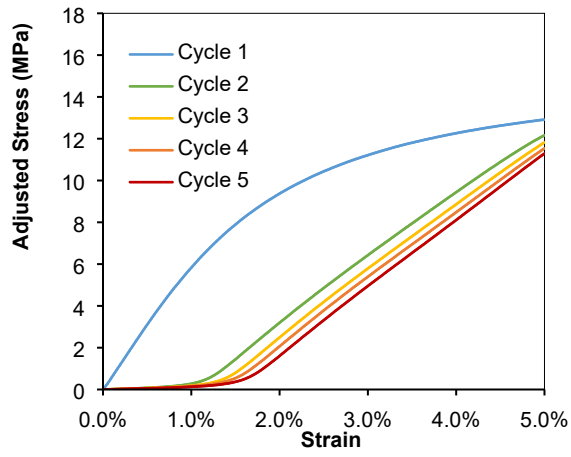
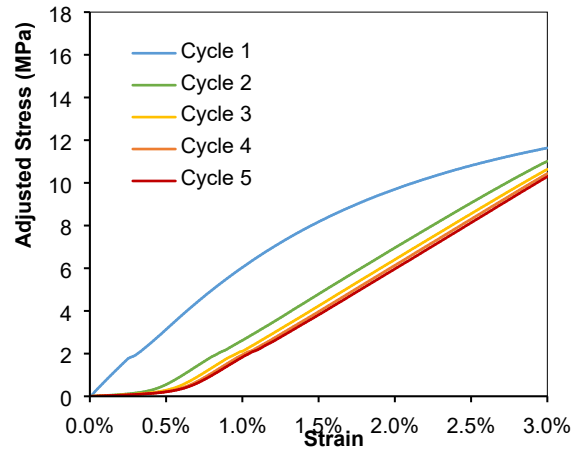
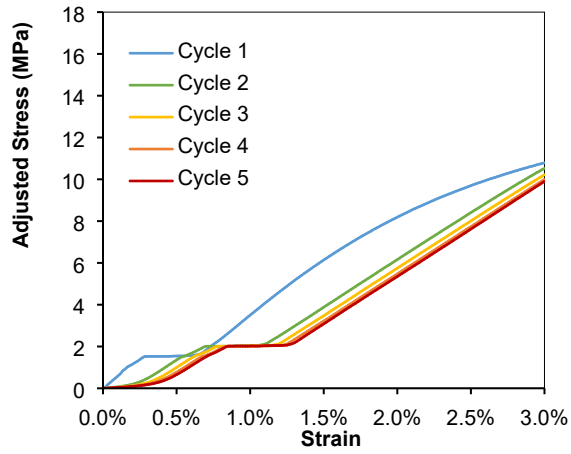


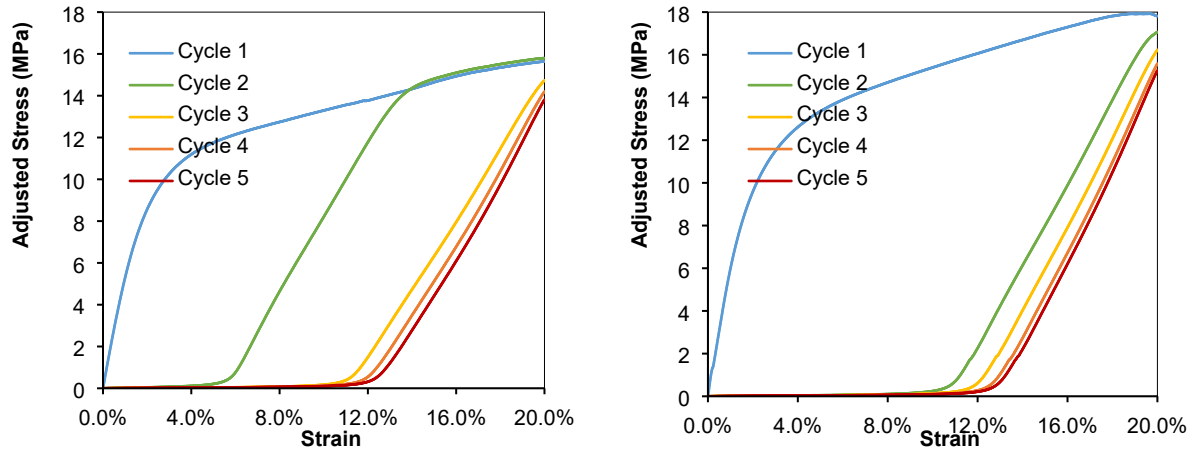
Figure S1. DSC data for an as-received (AR) stiff felt sample.

Adjusted stress-strain data for reversibility experiment

Stress-strain data for treated stiff felt specimens for the loading step over five cycles have been shown below. Stress data were adjusted by shifting stress values vertically by a constant value to have the stress at 0% strain to be 0 kPa, allowing for easier comparison between cycles. Included table shows the amount by which the stress values were shifted up.







Specimen 1 (left)	magnitude of stress (kPa) shifted vertically up					
Max. axial strain →	1%	2%	3%	5%	10%	20%
Cycle 1	2.6	619.1	-36.0	17.1	31.4	53.1
Cycle 2	135.4	632.2	475.1	183.6	409.6	441.3
Cycle 3	148.9	635.7	467.9	186.9	410.3	425.1
Cycle 4	167.0	630.8	467.5	185.5	415.4	428.1
Cycle 5	177.4	629.9	468.1	185.7	415.3	428.4

Specimen 2 (right)	magnitude of stress (kPa) shifted vertically up					
Max. axial strain →	1%	2%	3%	5%	10%	20%
Cycle 1	-1.1	17.1	0.1	0.3	-1.2	-0.4
Cycle 2	207.2	421.2	245.1	653.3	73.5	544.6
Cycle 3	252.0	364.1	233.1	662.3	74.3	546.8
Cycle 4	244.0	308.8	235.2	662.8	75.7	547.4
Cycle 5	284.6	384.7	245.4	655.2	76.6	548.1

Figure S2. Adjusted stress-strain data for treated stiff felt specimens (TR70) for the loading step over five cycles; plots correspond to the maximum axial strain of either 1, 2, 3, 5, 10 or 20% achieved during the reversibility experiments. Stress values in the plots are shown in MPa. Included tables show the magnitude by which the stress values (shown in kPa) were shifted.