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Supplementary Information

From waste to wearable: an alternative waste stream for unusable textiles turned into piezoelectric textiles

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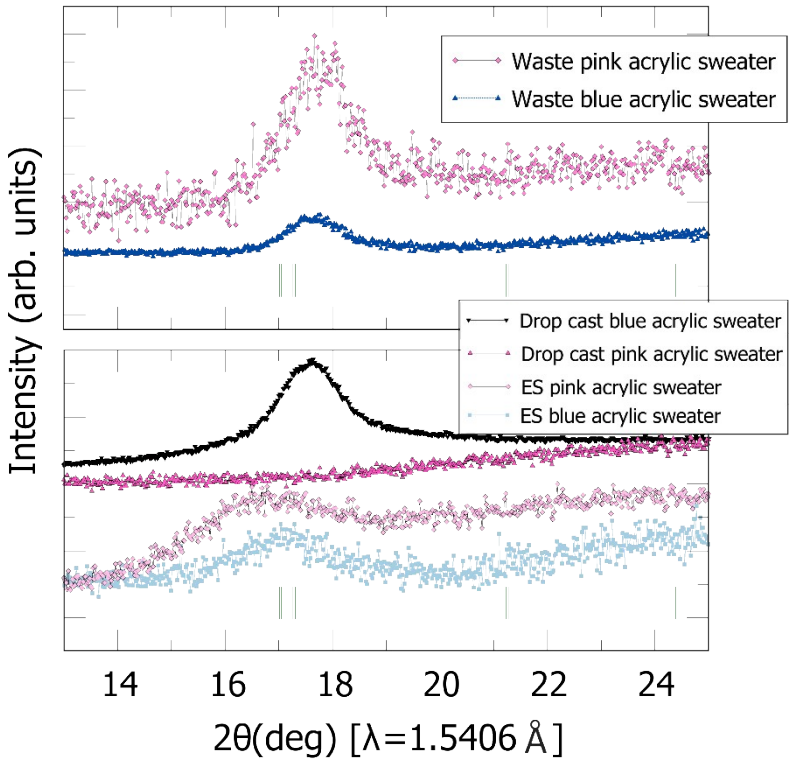
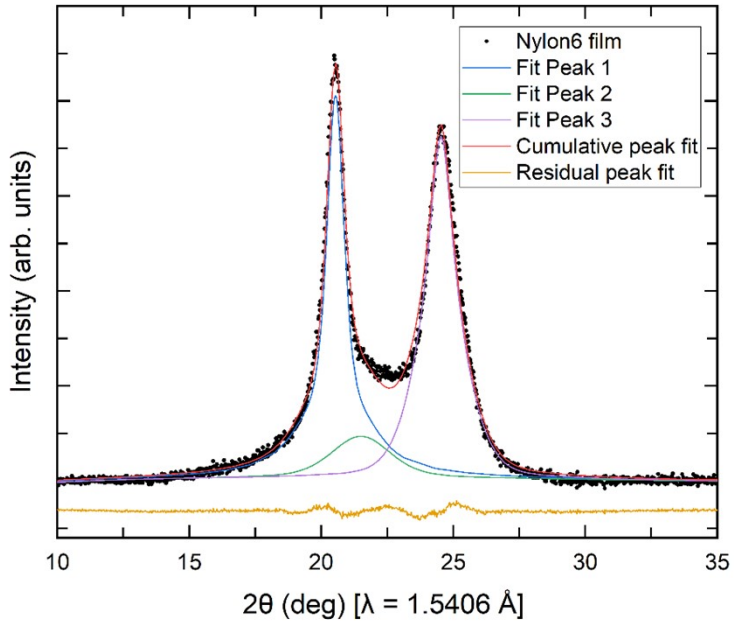
SI Figure 1. A sample bolt of electrospun, piezoelectric nanofiber material (white) using a production scale Nanospider (needleless) system.



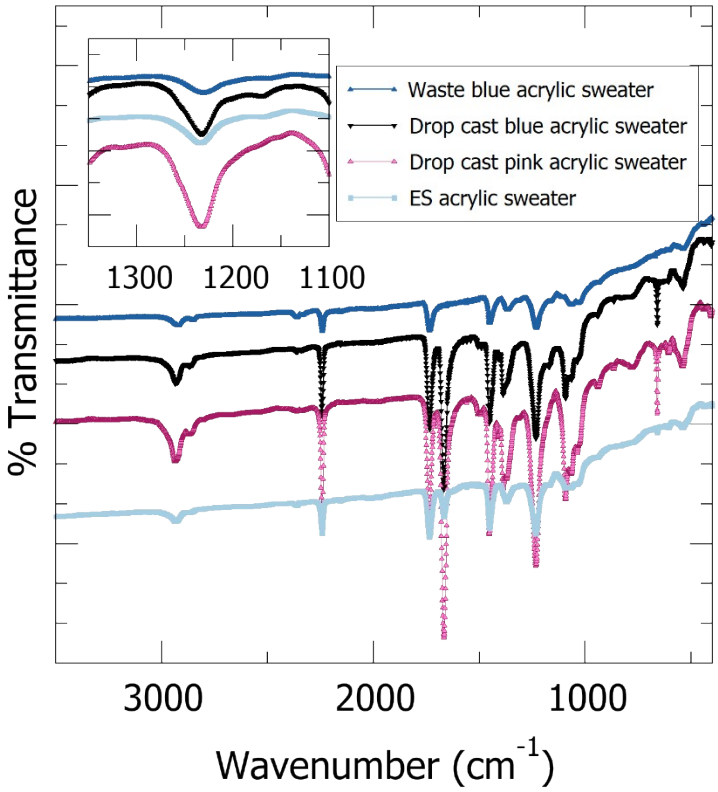
SI Figure 2. XRD data of all studied acrylic samples before and after processing. Green vertical tick marks are indexed crystallographic reflections.



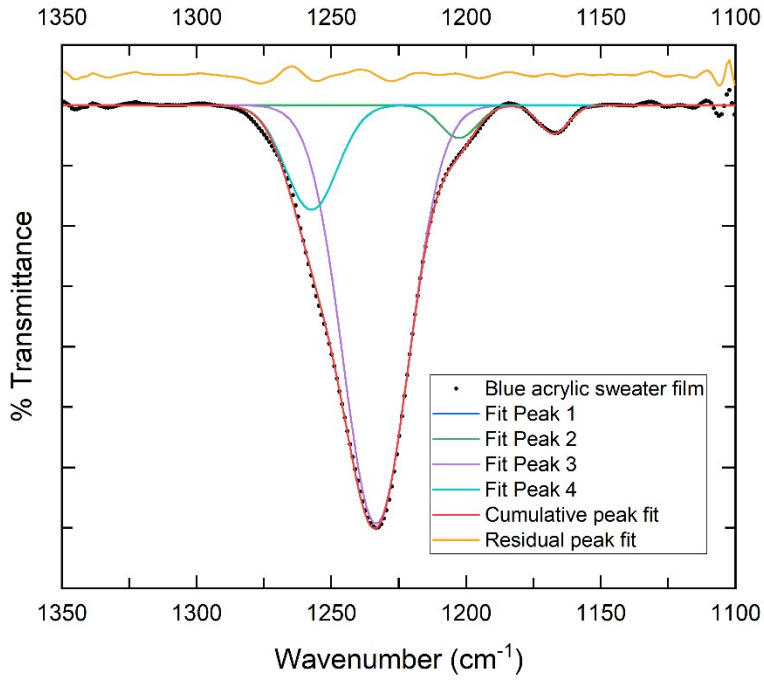
SI Figure 3. An example of the peak fitting conditions used to quantify the phases present in all samples analyzed. Raw data is represented as black dots, fit peaks as blue, green, and purple lines, and the cumulative fit as a red line. The difference line is indicated with a yellow low. Known phase peaks were fit using a Pseudo Voigt 2 profile and amorphous peaks were fit using a Gaussian profile.

Table 1. XRD peak analysis results from peak deconvolution.

Sample		2θ	Area (%)	Reflection
Acrylonitrile	Waste acrylic sweater (blue)	17.675	23.490	(100)
	ES acrylic sweater (blue)	17.082	16.151	(100)
	Drop cast acrylic sweater (blue)	17.672	45.764	(100)
	Waste acrylic sweater (pink)	17.748	80.729	(100)
	ES acrylic sweater (pink)	16.634	6.104	(100)
	Drop cast acrylic sweater (pink)	15.974	2.112	(100)
Nylon	Waste Nylon raincoat	20.323	28.019	α (200)
		21.437	12.951	γ (001)
		23.659	59.029	α (010)
	ES Nylon raincoat	21.731	5.609	α (200)
		22.202	77.105	γ (001)
		24.039	17.285	α (010)
	Drop cast Nylon raincoat	20.388	61.025	α (200)
		22.004	7.227	γ (001)
		24.459	31.747	α (010)



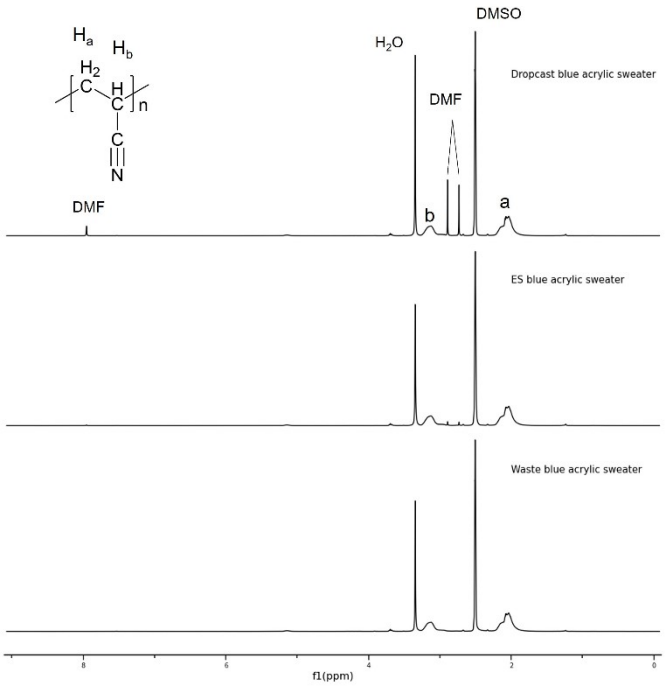
SI Figure 4. FTIR data of all acrylic samples analyzed with the area used (inset) to quantify the present phases.



SI Figure 5. An example of the peak fitting used to quantify the present phases of each material.

Table 2. FTIR peak analysis results obtained from the peak deconvolution performed on each material.

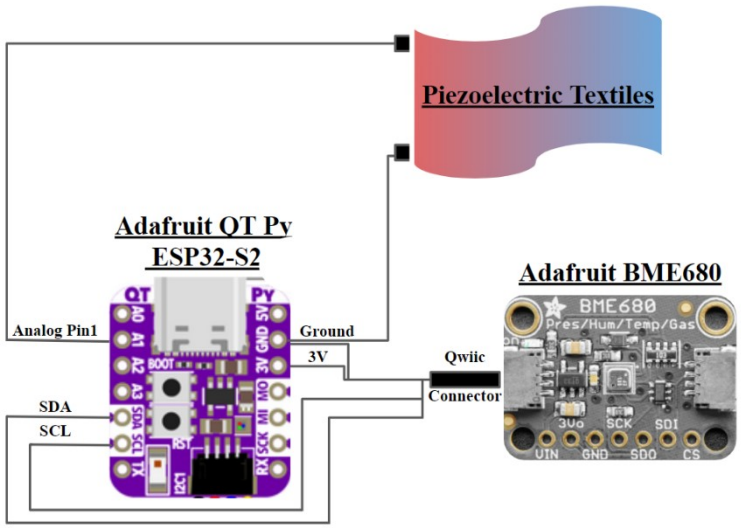
Sample		Wavenumber (cm^{-1})	Area (%)	Assigned phase
Acrylonitrile	Waste acrylic sweater (blue)	1232	94.7	3^1 helical
	ES acrylic sweater (blue)	1235	89.4	3^1 helical
		1262	6.8	Zig zag
	Drop cast acrylic sweater (blue)	1233	78.8	3^1 helical
		1257	15.4	Zig zag
	ES acrylic sweater (pink)	1235	77.8	3^1 helical
		1258	11.1	Zig zag
	Drop cast acrylic sweater (pink)	1231	43.8	3^1 helical
		1250	27.2	Zig zag
Nylon	Waste Nylon raincoat	927	27.3	α
		972	26.9	γ
	ES Nylon raincoat	929	3.5	α
		974	50.6	γ
	Drop cast Nylon raincoat	928	45.4	α
		--	--	γ



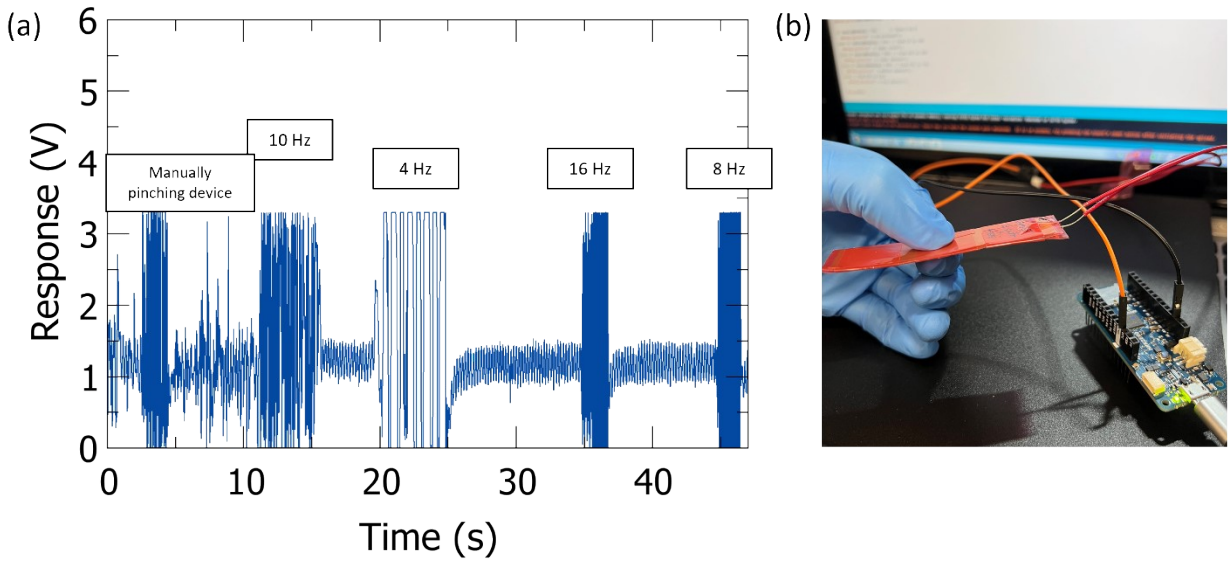
SI Figure 6. 1H-NMR data of the blue acrylic sweater samples. The broad peaks around 2 and 3.2 ppm indicate a polymerized sample associated with PAN. Additional sharp peaks were assigned to the solvents used in either sample preparation or sample synthesis.

Table 3. Results of the linearly fit cantilever data of each material.

Sample		Linear equation	Correlation coefficient
PAN	Waste acrylic sweater (blue)	$y = \mathbf{374}\,x$ - 98.22	0.980
	ES acrylic sweater (blue)	$y = \mathbf{30395}\,x$ - 827.56	0.935
	Drop cast acrylic sweater (blue)	$y = \mathbf{3189}\,x$ - 17.33	0.992
	Waste acrylic sweater (pink)	$y = \mathbf{178}\,x$ – 69.69	0.892
	ES acrylic sweater (pink)	$y = \mathbf{10263}\,x$ – 115.00	0.756
	Drop cast acrylic sweater (pink)	$y = \mathbf{3880}\,x$ – 8.02	0.958
Nylon	Waste Nylon raincoat	$y = \mathbf{3749}\,x$ - 7.96	0.921
	ES Nylon raincoat	$y = \mathbf{26835}\,x$ - 198.34	0.971
	Drop cast Nylon raincoat	$y = \mathbf{3473}\,x$ - 79.39	0.864



SI Figure 7. Block diagram of the electronic textile and gas sensors.



SI Figure 8. (a) Preliminary pressure sensor responses as a function of either manual pinching or specific frequency excitation using the cantilever device. (b) Image of an electrospun blue acrylic sweater device connected to the MKR Arduino device for sensor output measurements.