Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

Silver Fractal Dendrites for Highly Sensitive and Transparent Polymer Thermistors

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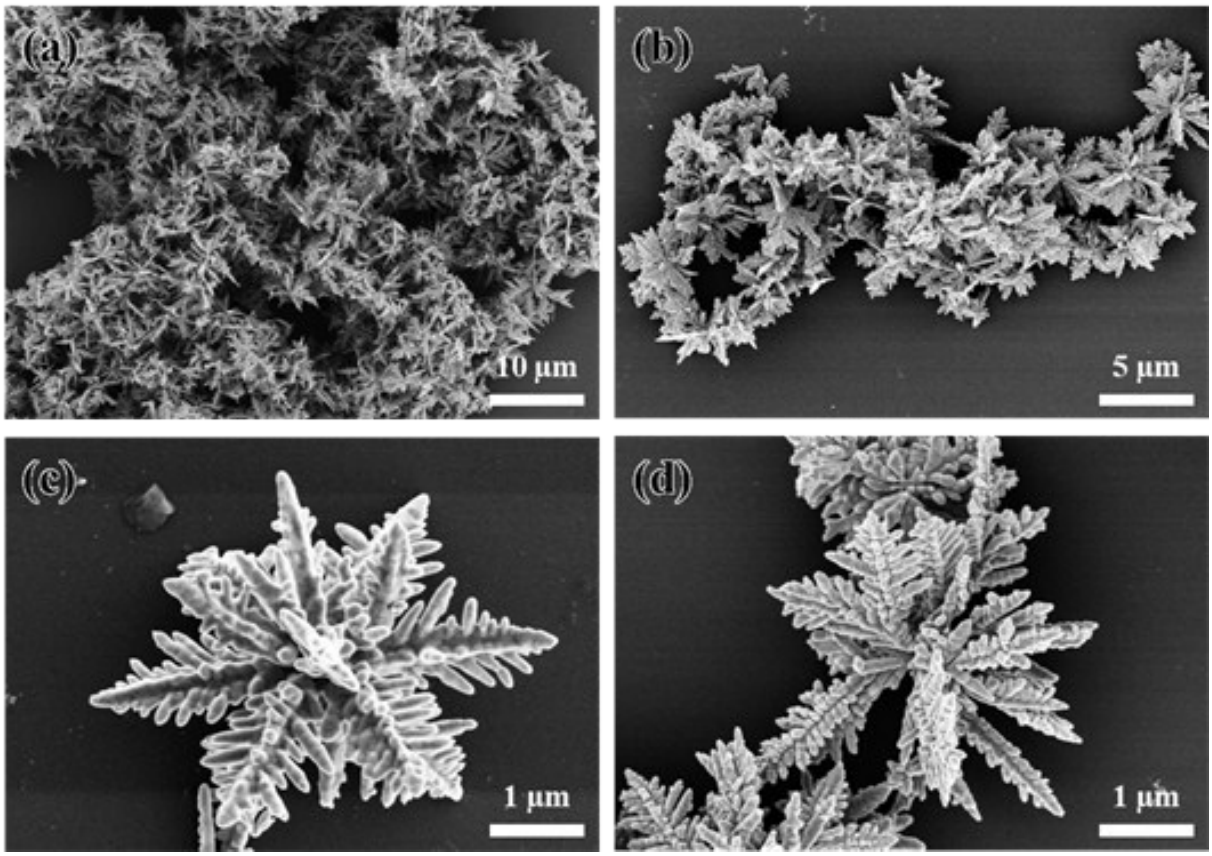

Figure S1. SEM images of silver fractal dendrites (AgFDs).

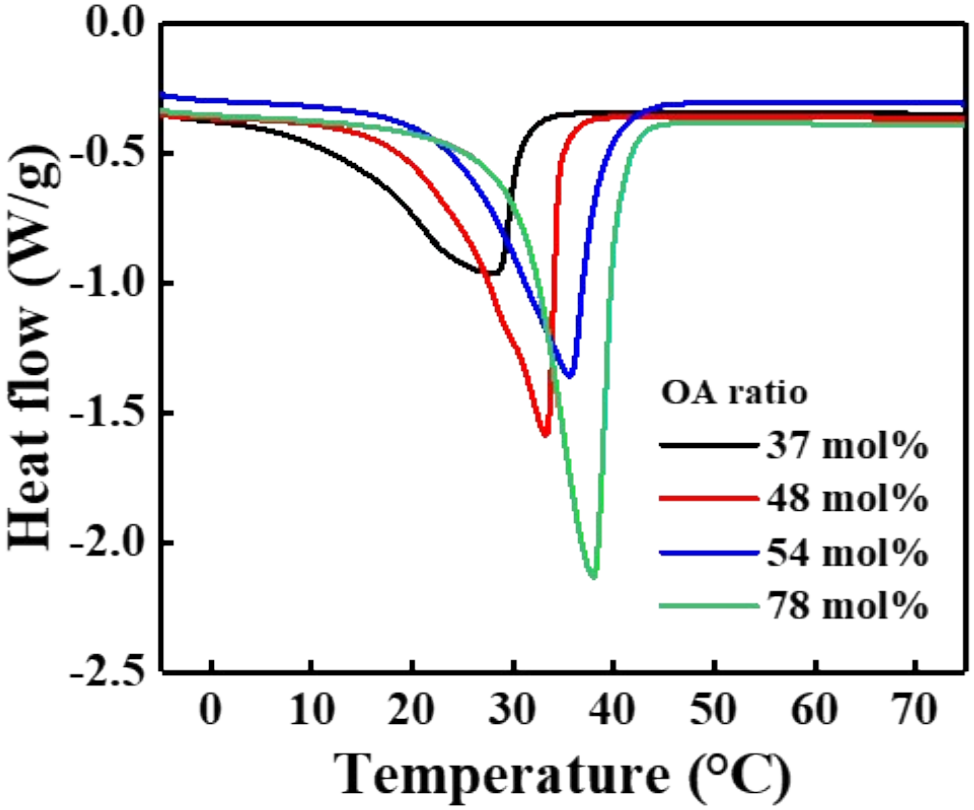

Figure S2. DSC data of polyacrylates with various octadecyl acrylate (OA) ratio.

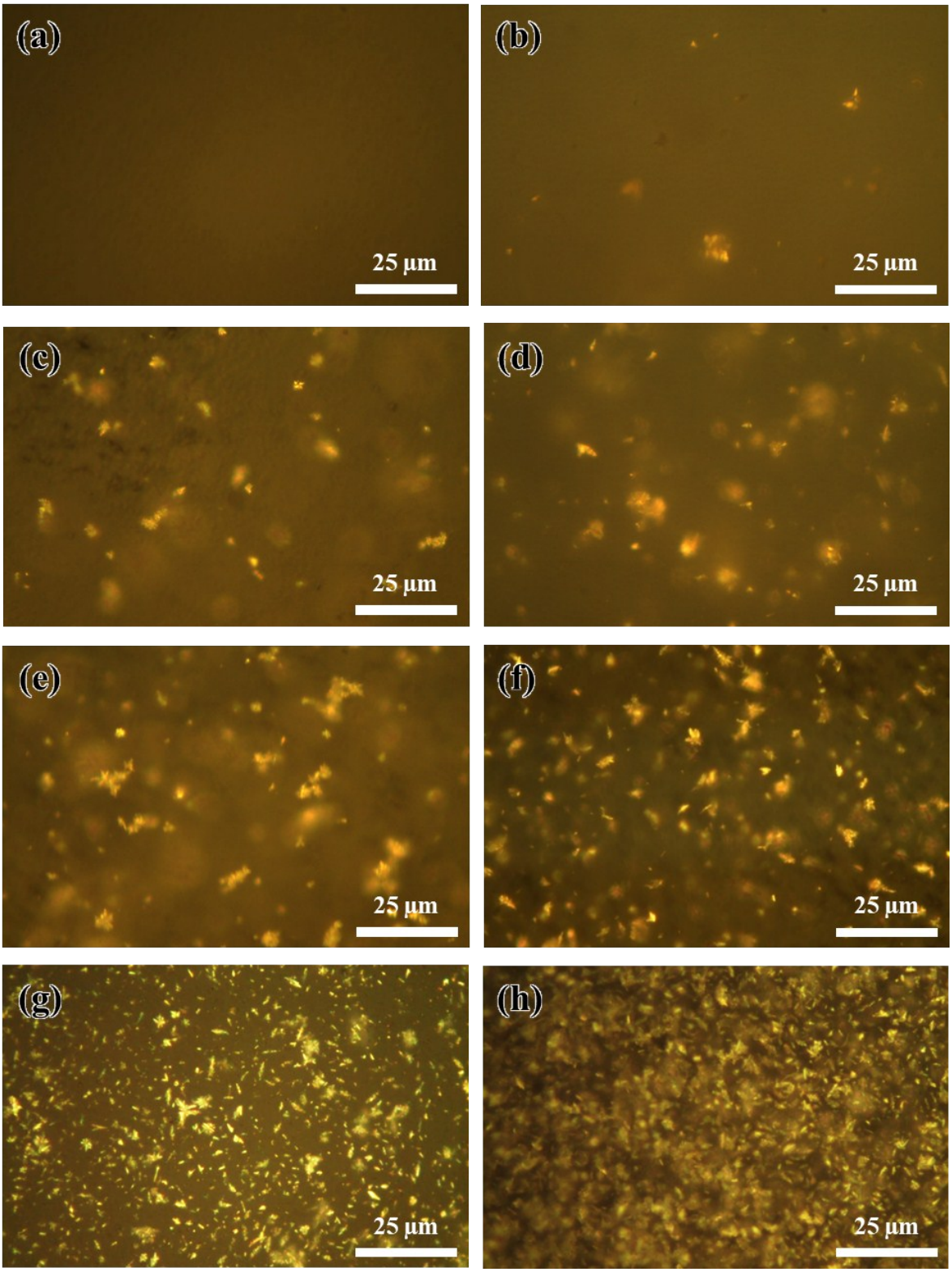

Figure S3. OM images of AgFDs-PA composite films with various loading concentrations of AgFDs in the PA matrix (a) 0 wt%, (b) 0.2 wt%, (c) 0.4 wt%, (d) 0.6 wt%, (e) 1 wt%, (f) 2.5 wt%, (g) 10 wt%, and (h) 33.3 wt%.

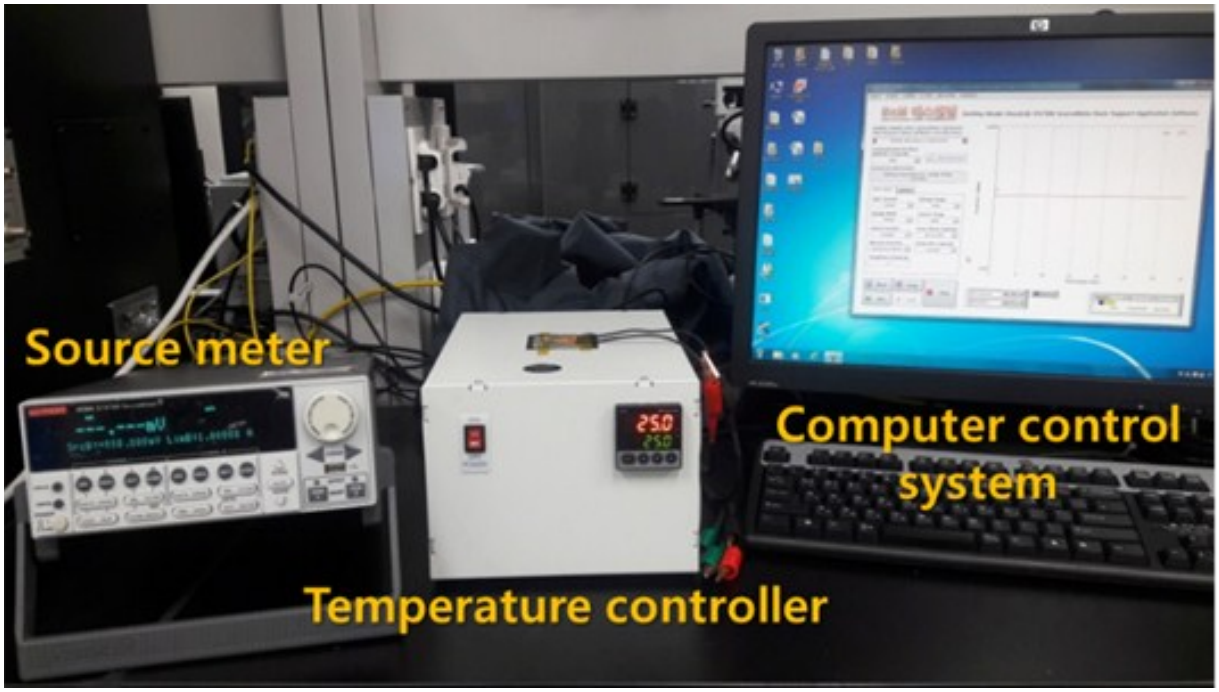

Figure S4. Photograph of a computer controlled custom-made system with digital source meter and temperature controller for current and voltage (I-V) measurement.

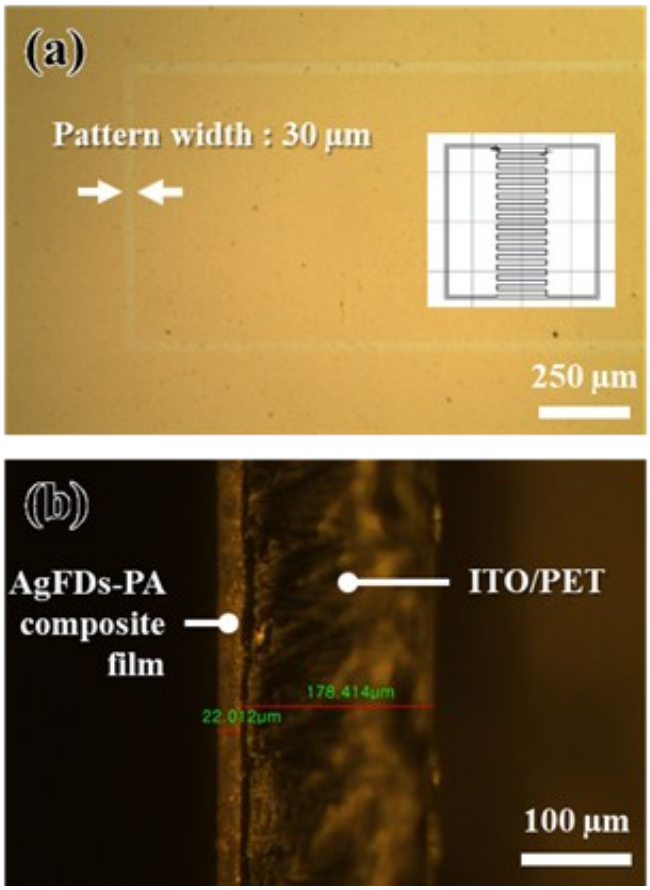

Figure S5. OM images of (a) patterned ITO/PET electrode, and (b) thickness of the thermistor.

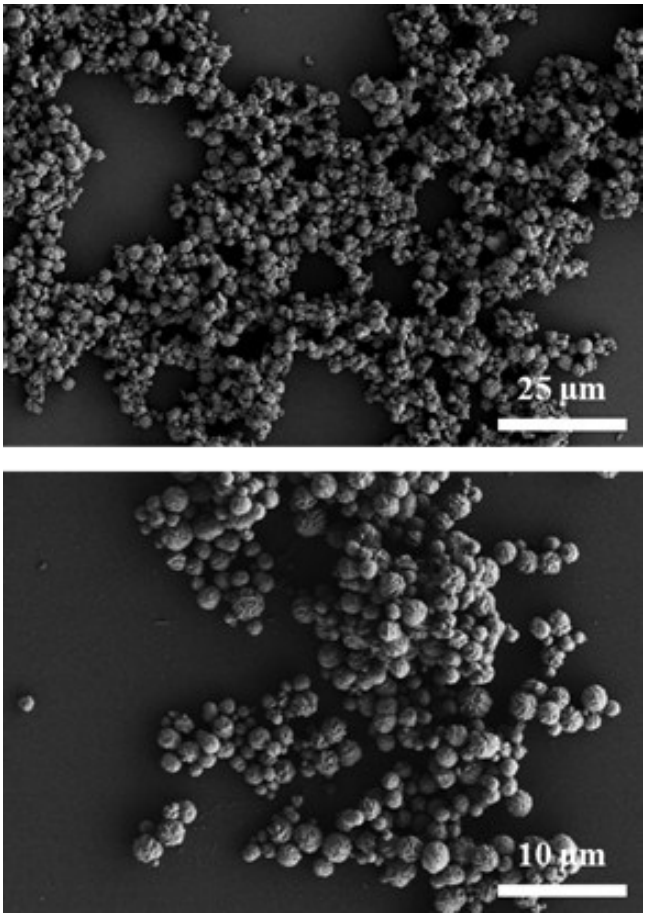

Figure S6. SEM images of spherical silver microparticles (AgMPs).

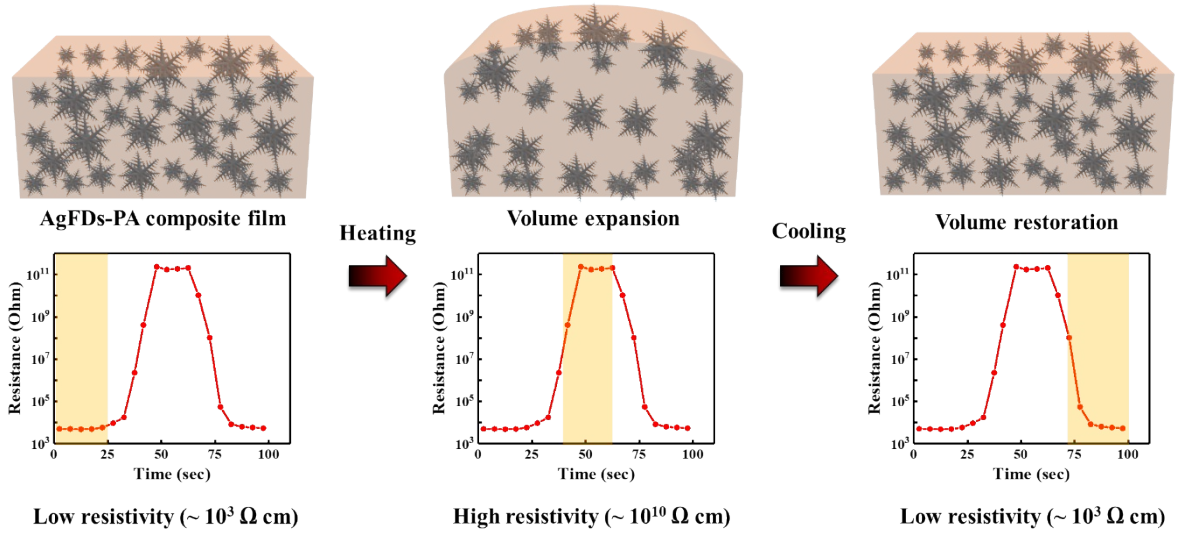

Figure S7. Mechanism diagram for PTC effect of AgFDs-PA composite film.

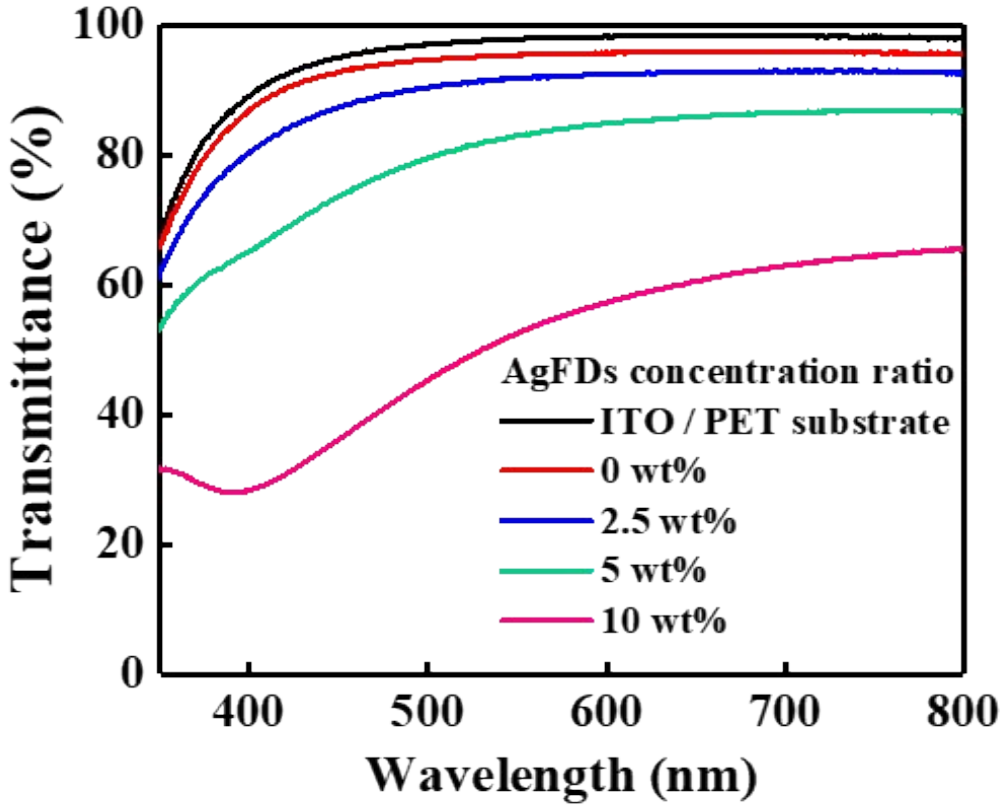

Figure S8. UV-Vis spectra of AgFDs-PA composite films with various loading concentrations of AgFDs on ITO/PET substrate.

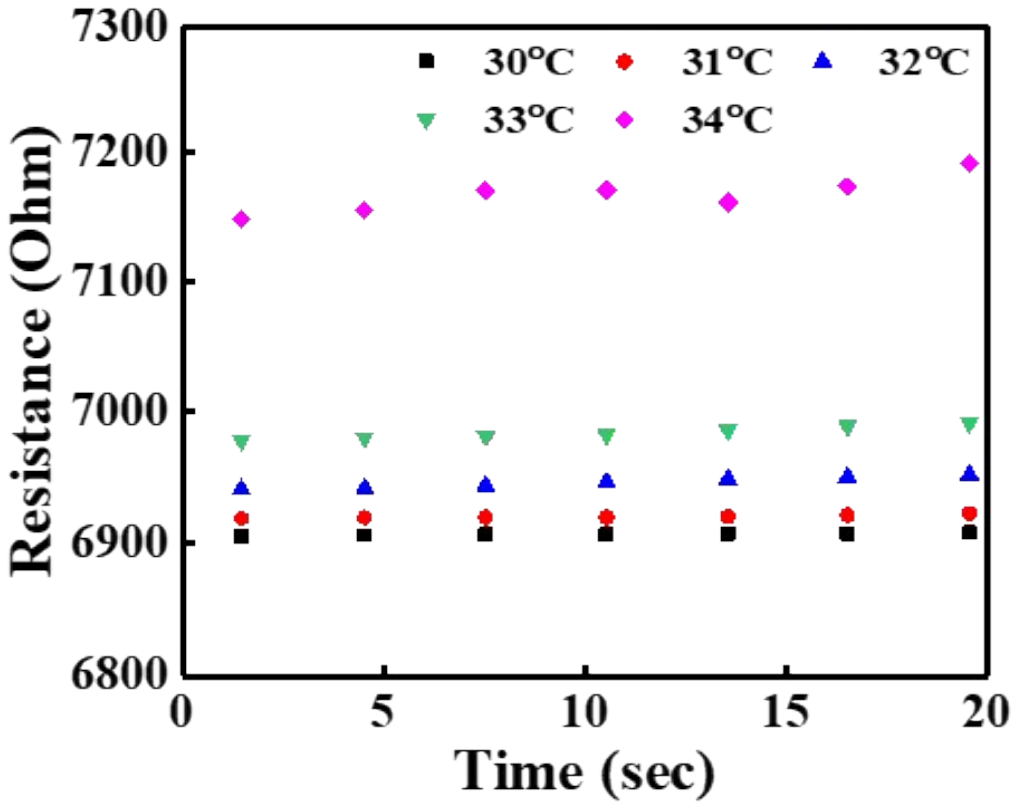

Figure S9. Resistance change in temperature range from 30 °C to 34 °C.

Table S1. PTC intensity values of various PTC polymer thermistors.

Conducting material	Polymer matrix	T_m [a]	PTC intensity [b]	Ref.
Ni nanoparticle	Polyethylene	95 ˚C	10^6~10^7	1
	Polystyrene	240 ˚C	10~10^3	
	Poly methyl methacrylate	300 ˚C	<10	
	Poly vinyl acetate	-	10~10^2	
	Polyethylene oxide	46 ˚C	10^6~10^7	
	Polyethylene adipate	40 ˚C	10^6~10^7	
Graphite	Linear low density/high density polyethylene	131.5 ˚C ~128.1 ˚C	10^0~10^3	2
Carbon nanotube	Polypropylene	166.4 ˚C	10^5~10^6	3
	High density polyethylene	135 ˚C	10~10^4	4
Ag-reduced graphene oxide	Polyvinylidene fluoride	-	10^3~10^4	5
Graphene nanosheet	Ultra high molecular weight polyethylene	137 ˚C	10^2~10^3	6
Graphene nanoplatelet		-	10~10^6	7
AgFDs	**Polyacrylate**	**34 ˚C**	**10^6~10^7**	**This work**

[a] Melting point; [b] PTC intensity is defined as the peak resistivity divided by the initial resistivity (at room temperature).

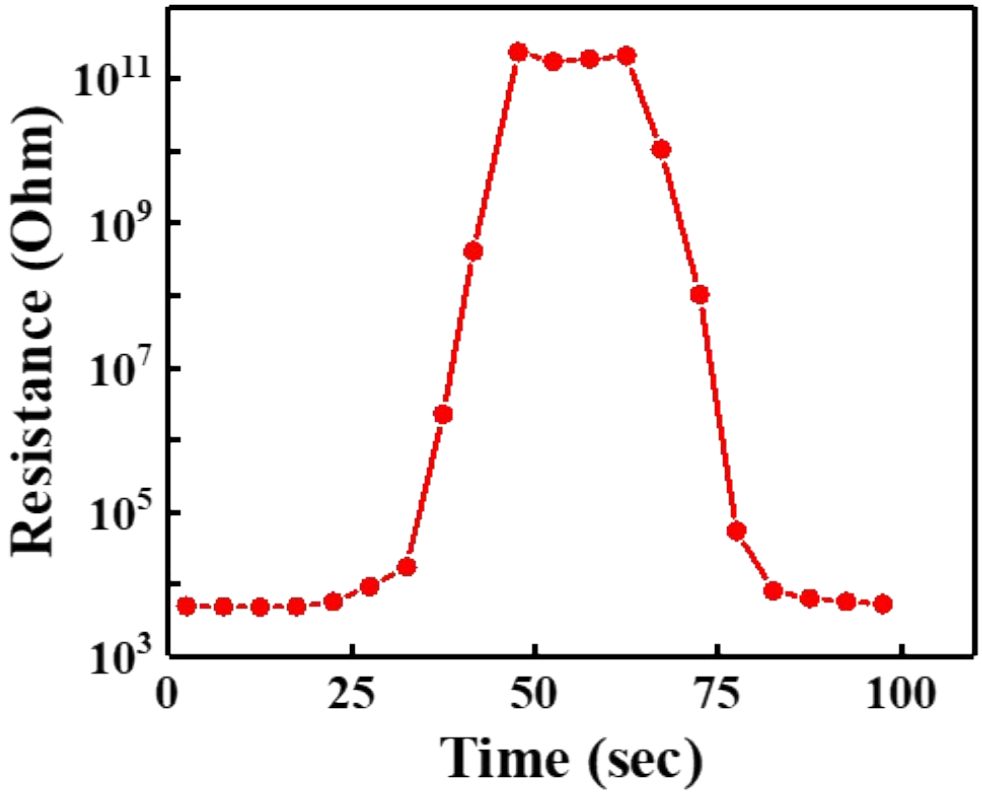

Figure S10. Real-time resistance change in rapid temperature change (ΔT = 20 °C) for a single heating and cooling cycle.

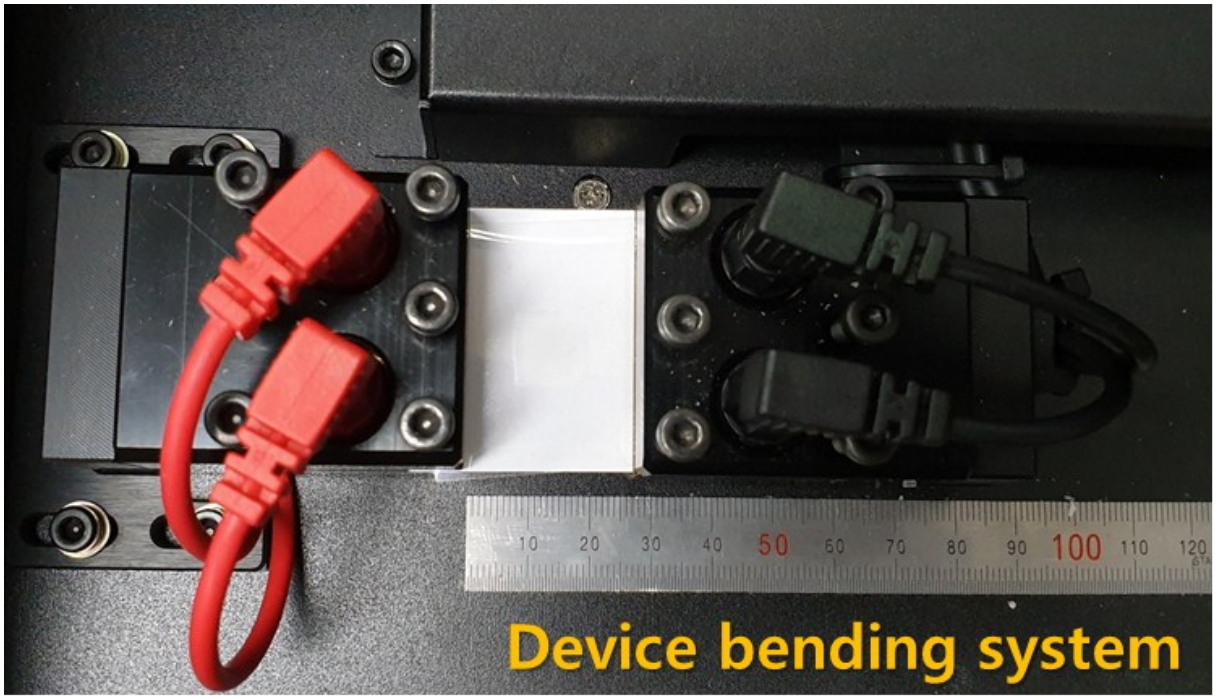

Figure S11. Photograph of a custom-made device bending system.

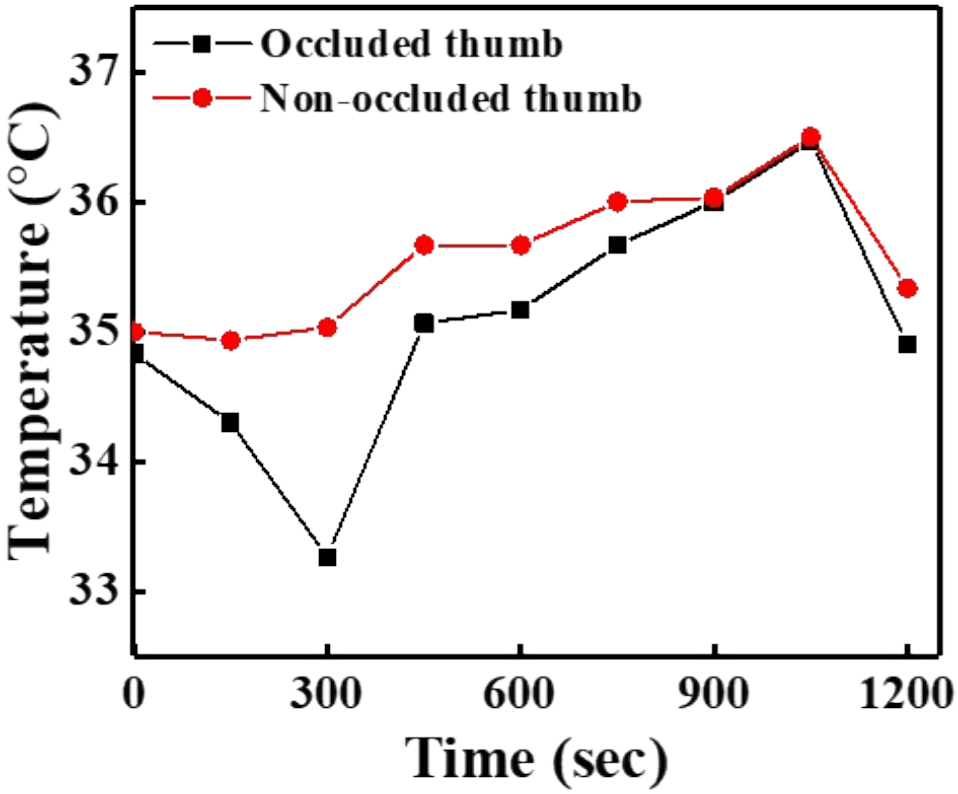

Figure S12. Thumb temperature of occluded (black) right hand and non-occluded (red) left hand measured by an IR camera.

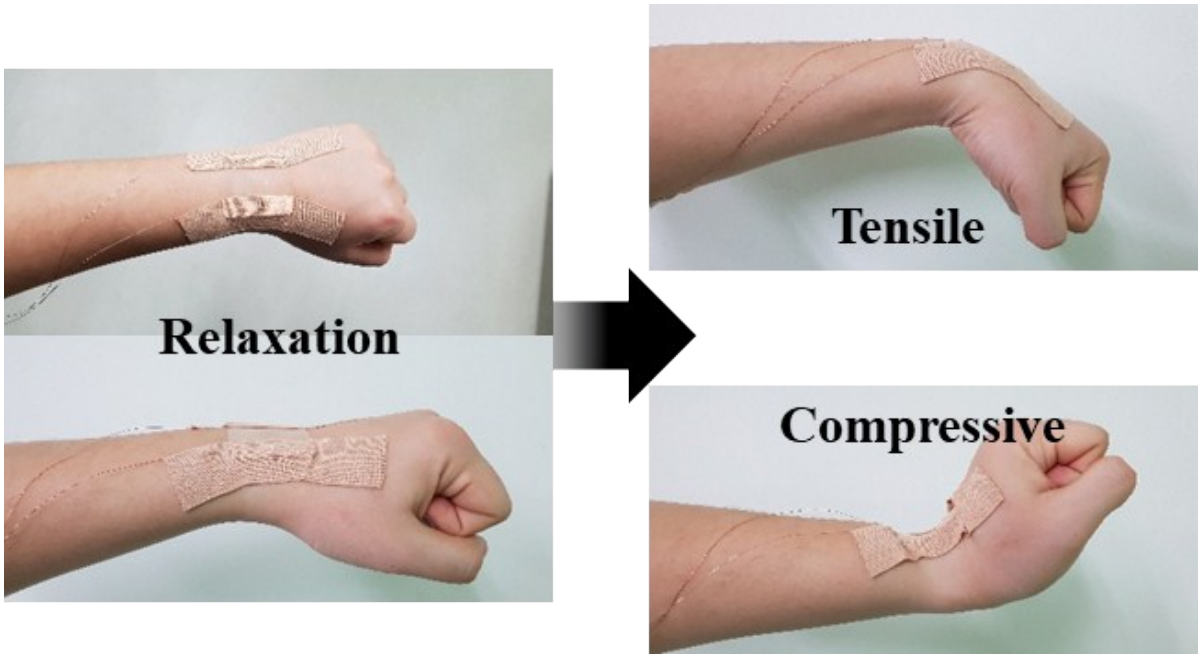

Figure S13. Photographs of the thermistor attached to the human wrist.

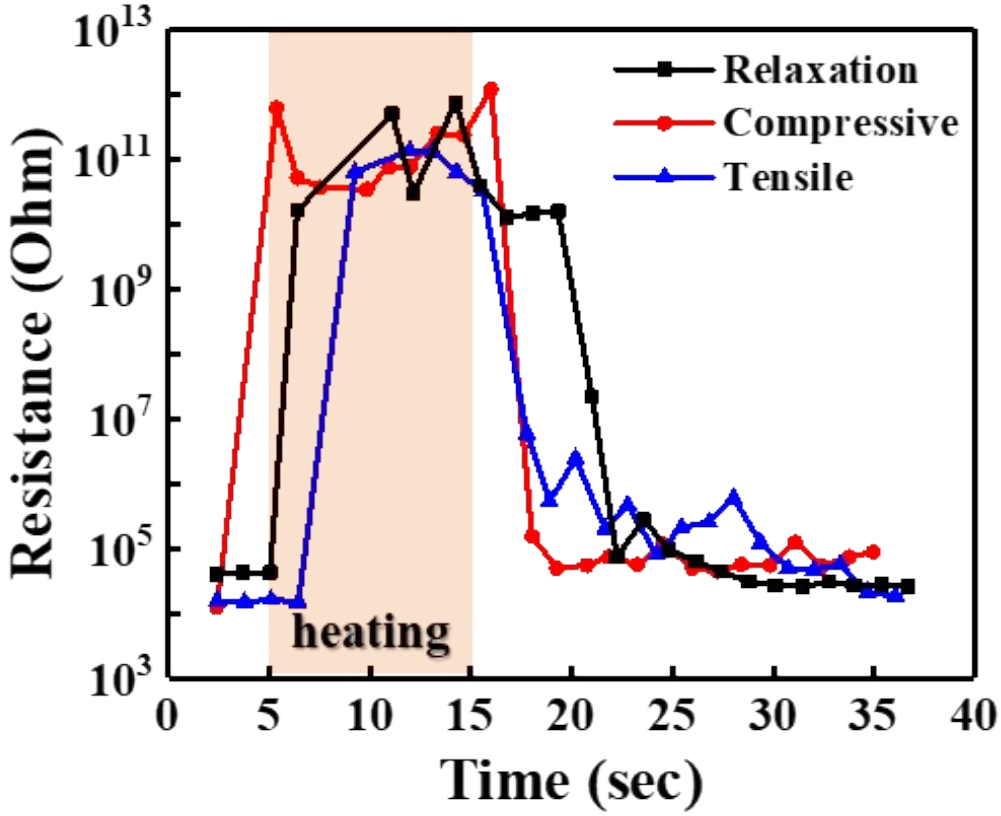

Figure S14. Changes in real-time resistance of the thermistor attached to the human wrist through a single heating & cooling cycle.

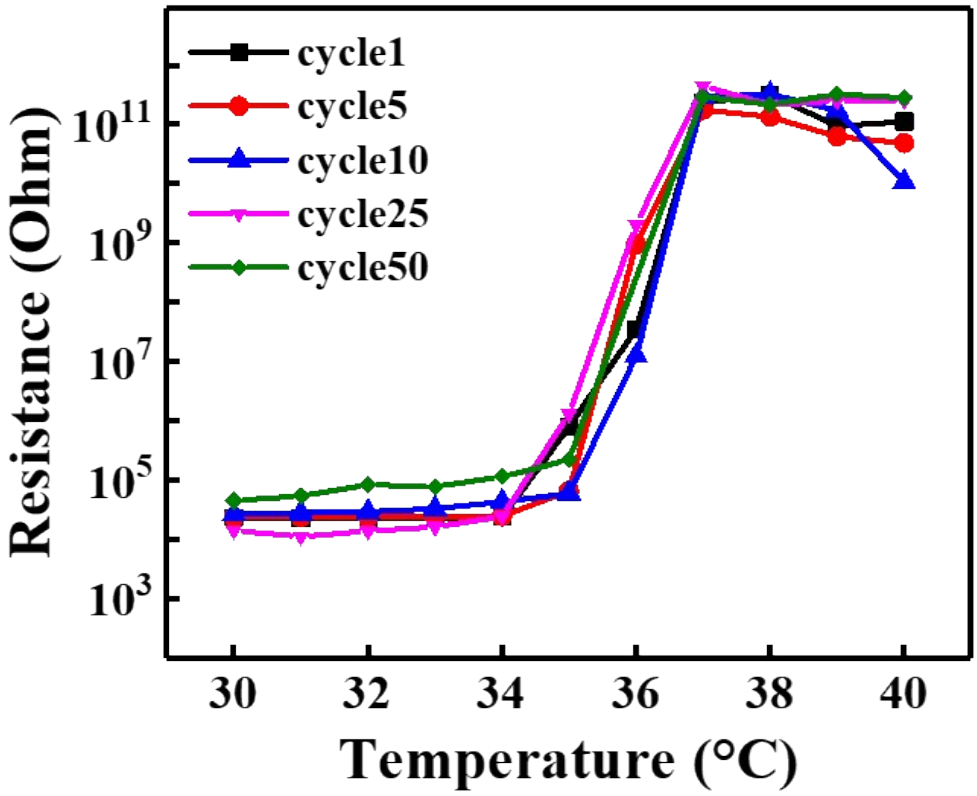

Figure S15. Cycling stability test of the AgFDs-PA composite based thermistor in the range of 30 °C to 40 °C.

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References

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