Supplementary Materials

2S-Soy Protein-Based Biopolymer as a Non-Covalent Surfactant and its Effects on Electrical Conduction and Dielectric Relaxation of Polymer Nanocomposites

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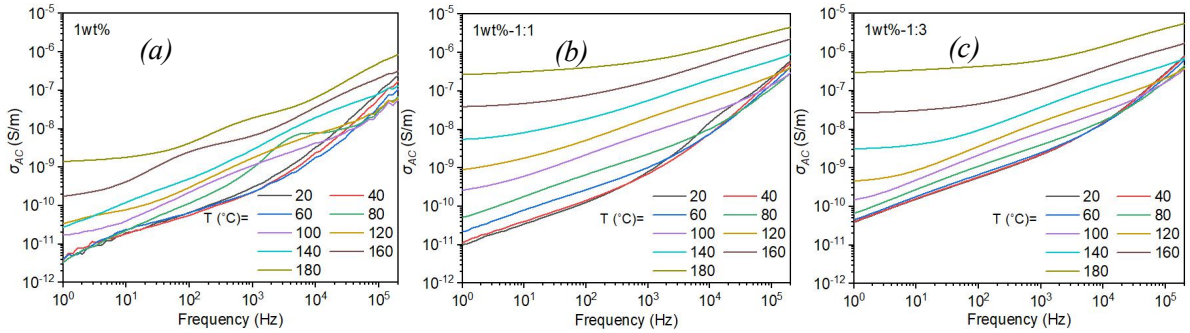

Figure S1. AC conductivity of 1 wt% nanocomposites from RT to 180°C: (a) 1wt% CNF, (b) 1wt% sCNF-1:1, (c) 1wt% sCNF-1:3

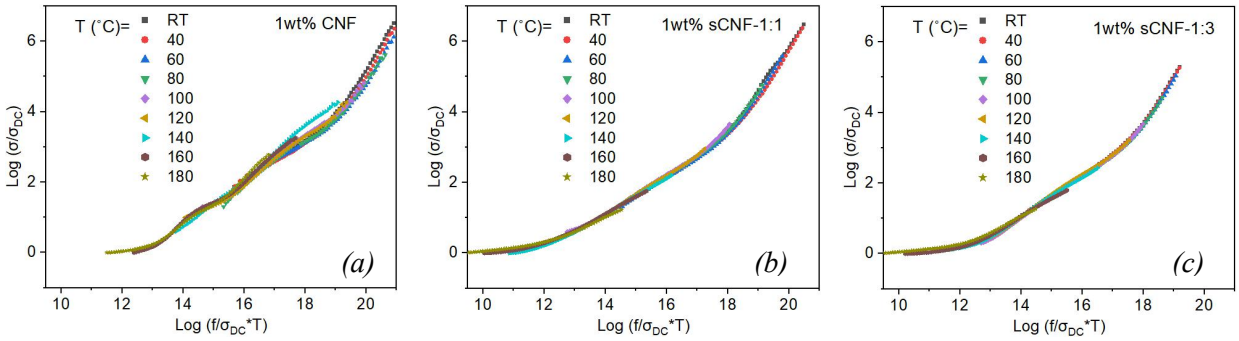

Figure S2. Conductivity master curves of 1wt% nanocomposites: (a) 1wt% CNF, (b) 1wt% sCNF-1:1, (c) 1wt% sCNF-1:3

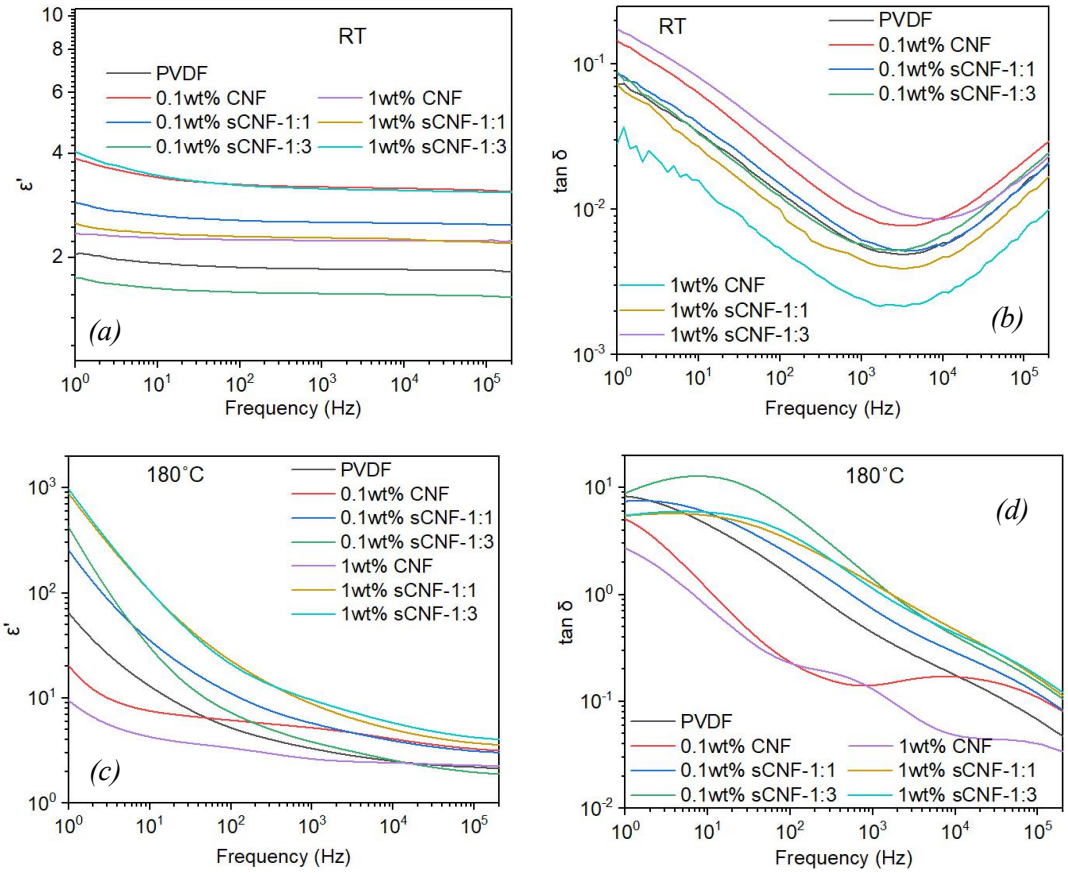

Figure S3. Dielectric constant (*ε'*) and loss factor (*tan δ*) of pure PVDF and the nanocomposites at (a, b) RT and (c, d) 180˚C, respectively

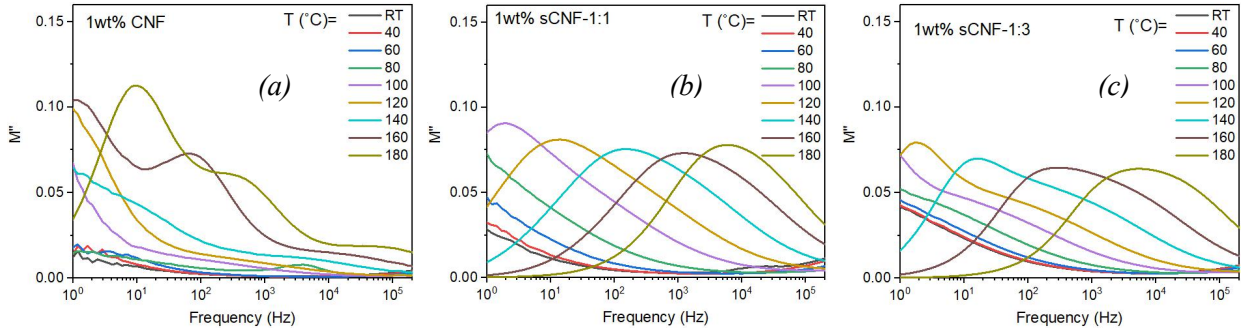

Figure S4. *M''* vs. frequency plots of 1 wt% nanocomposites from RT to 180˚C: (a) 1wt% CNF, (b) 1wt% sCNF-1:1, (c) 1wt% sCNF-1:3

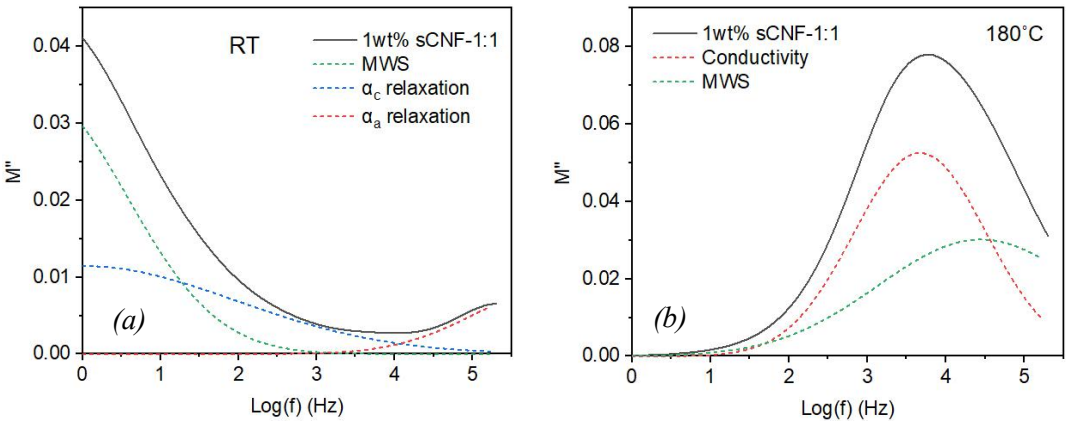

Figure S5. Self-convolution peak fitting examples: 1wt% sCNF-1:1 nanocomposite at RT and 180˚C, respectively

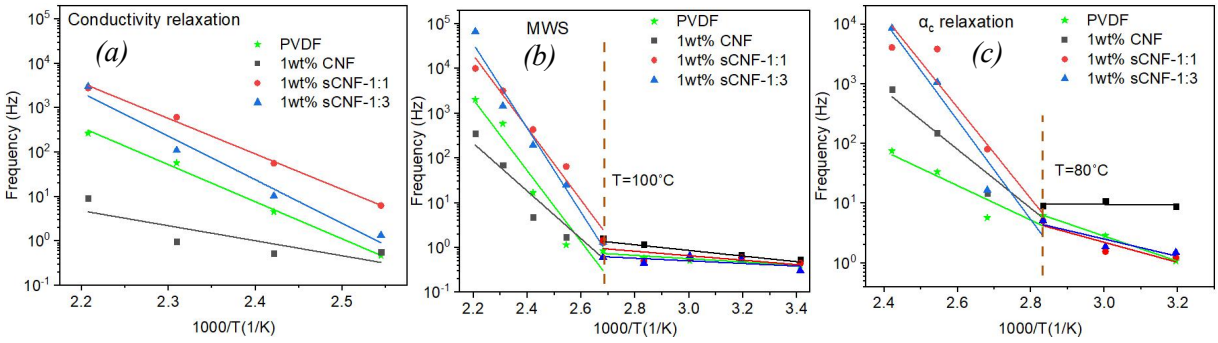

Figure S6. Arrhenius plots for (a) conductivity relaxation, (b) MWS relaxation, and (c) α_c relaxation for pure PVDF and 1wt% nanocomposites

Table S1. Activation energy (in eV) of conductivity, MWS and α_c relaxations from HN fitting

		PVDF	0.1wt% CNF	0.1wt% sCNF-1:1	0.1wt% sCNF-1:3	1wt% CNF	1wt% sCNF-1:1	1wt% sCNF-1:3
Conductivity relaxation		0.182	0.167	0.186	0.184	0.125	0.309	0.372
MWS	≥ 100˚C	0.491	0.501	0.568	0.511	0.318	0.570	0.707
	≤ 100˚C	0.300	0.370	0.443	0.266	0.209	0.269	0.148
α_c relaxation	≤ 80˚C	0.018	0.015	0.018	0.012	0.018	0.026	0.025

Note: HN fitting was not able to obtain E_a *for* α_c relaxation ≥ 80˚C, due to large fitting error caused by very small $\Delta\varepsilon$ for α_c relaxation in equation (5)

Table S2. Havriliak-Negami function parameters for conductivity and MWS relaxations at 160˚C

Relaxation type		PVDF	0.1wt% CNF	0.1wt% sCNF-1:1	0.1wt% sCNF-1:3	1wt% CNF	1wt% sCNF-1:1	1wt% sCNF-1:3
Conductivity relaxation	α_1	1.00	0.98	1.00	1.00	1.00	1.00	1.00
	β_1	1.00	1.00	1.00	0.63	0.21	0.61	0.73
	τ_1	3.00E-01	1.45E-01	2.25E-01	2.29E-01	4.16E-01	8.62E-02	8.82E-02
	$\Delta\varepsilon_1$	179.83	1.80	35.90	27.02	1.55	216.50	127.59
MWS	α_2	0.66	0.62	1.00	0.55	1.00	0.52	0.55
	β_2	0.71	1.00	0.39	1.00	1.00	1.00	1.00
	τ_2	1.90E-02	2.26E-04	1.15E-02	1.35E-04	3.80E-03	1.64E-04	2.11E-04
	$\Delta\varepsilon_2$	15.06	2.34	8.73	11.58	0.69	2.93	2.92