Effect of Electrospinning Parameters and Polymer Concentrations on Mechanical-to-electrical Energy Conversion of Randomly-Oriented Electrospun Poly(vinylidene fluoride) Nanofiber Mats

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S1 Morphology of the PVDF nanofibers prepared at different PVDF concentrations

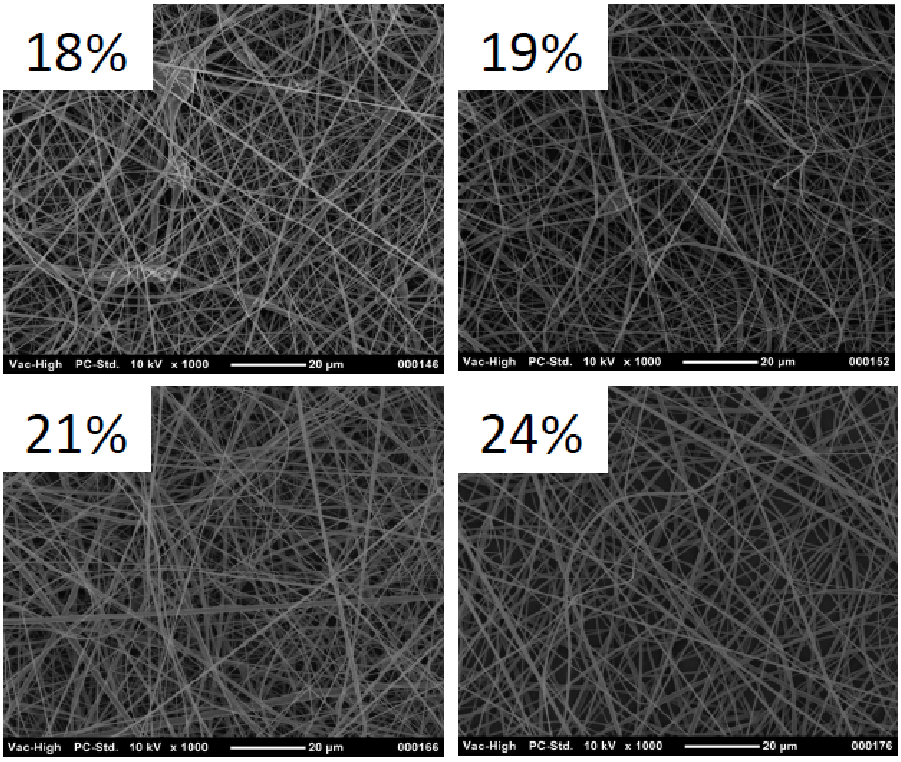

Figure S1 SEM images of the PVDF nanofibers prepared at different PVDF concentrations (Applied voltage: 15 kV; Spinning distance: 15 cm; Nanofiber web thickness: 70 µm)

S2 Morphology of the PVDF nanofibers prepared at different applied voltages

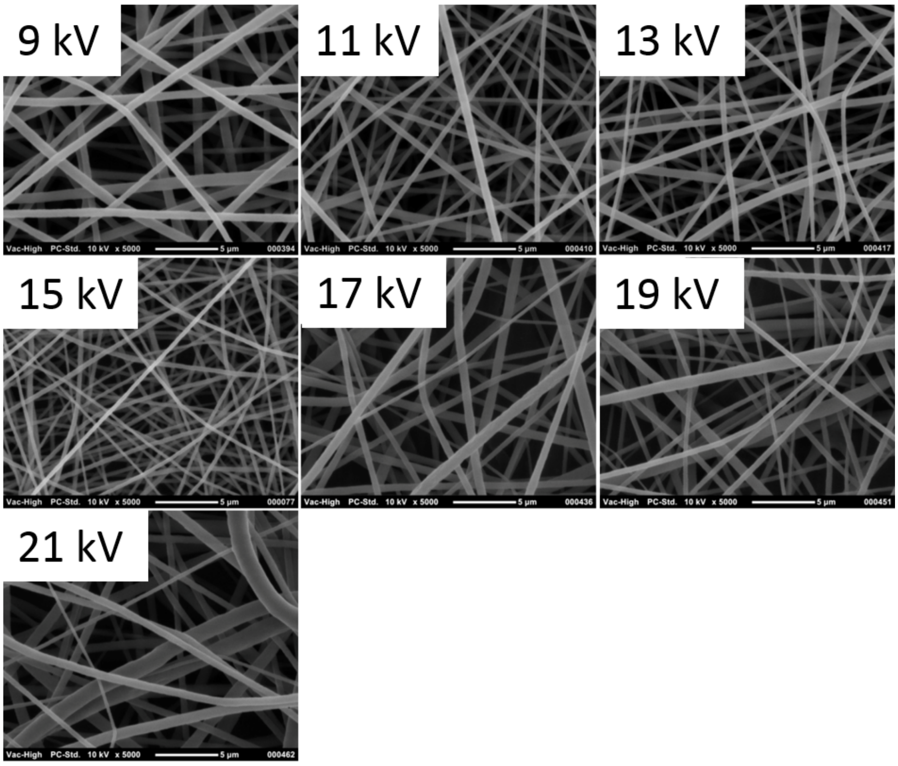

Figure S2 SEM images of the PVDF nanofibers prepared at different applied voltages (Solution concentration: 20%; Spinning distance: 15 cm; Nanofiber web thickness: 100 μm)

S3 XRD result of the PVDF nanofiber webs prepared at different applied voltages

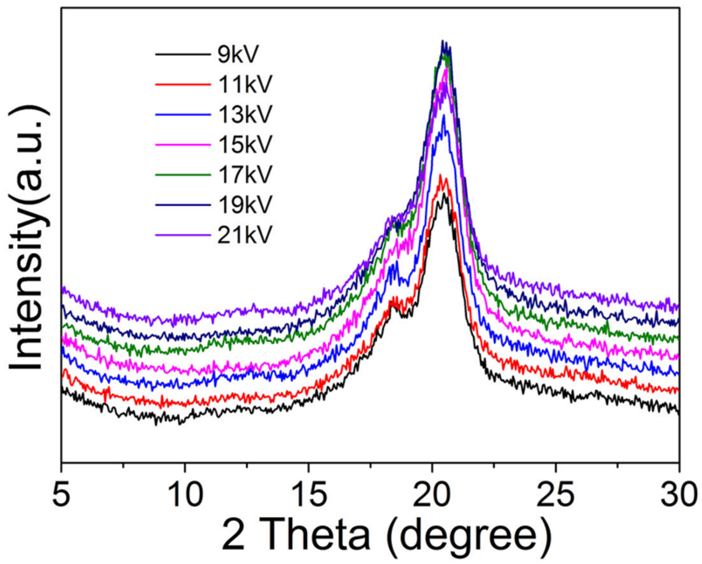

Figure S3 XRD curves of the PVDF nanofiber webs prepared at different applied voltages (Solution concentration: 20%; Spinning distance: 15 cm; Nanofiber web thickness: 100 μm)

S4 FTIR result of the PVDF nanofiber webs prepared at different applied voltages

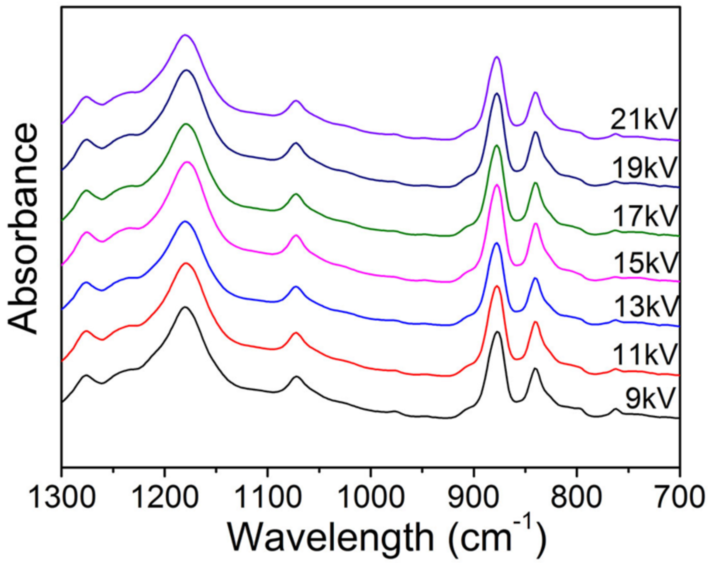

Figure S4 FTIR spectra of the PVDF nanofiber webs prepared at different applied voltages (Solution concentration: 20%; Spinning distance: 15 cm; Nanofiber web thickness: 100 μm)

S5 Electrical outputs of the PVDF nanofiber webs prepared at different applied voltages

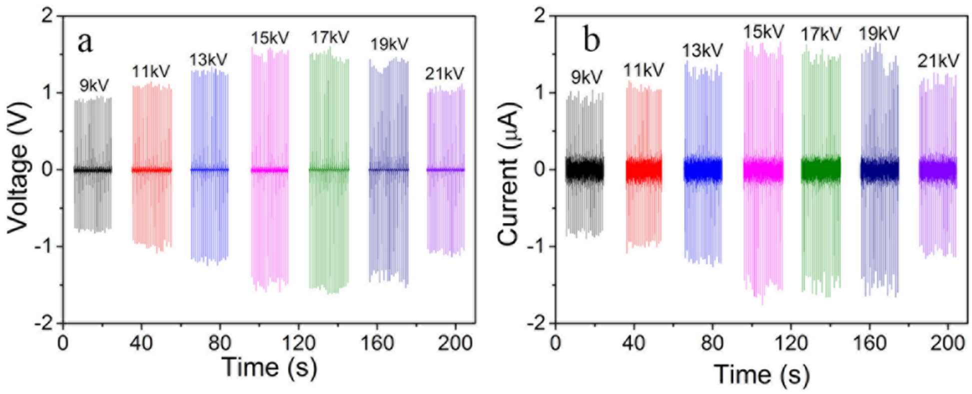

Figure S5 Voltage and current outputs of the PVDF nanofiber webs prepared at different applied voltages (Solution concentration: 20%; Compression force: 10N; Frequency: 1 Hz; Spinning distance: 15 cm; Nanofiber web thickness: 100 μm)

S6 Morphology of the PVDF nanofibers prepared at different spinning distances

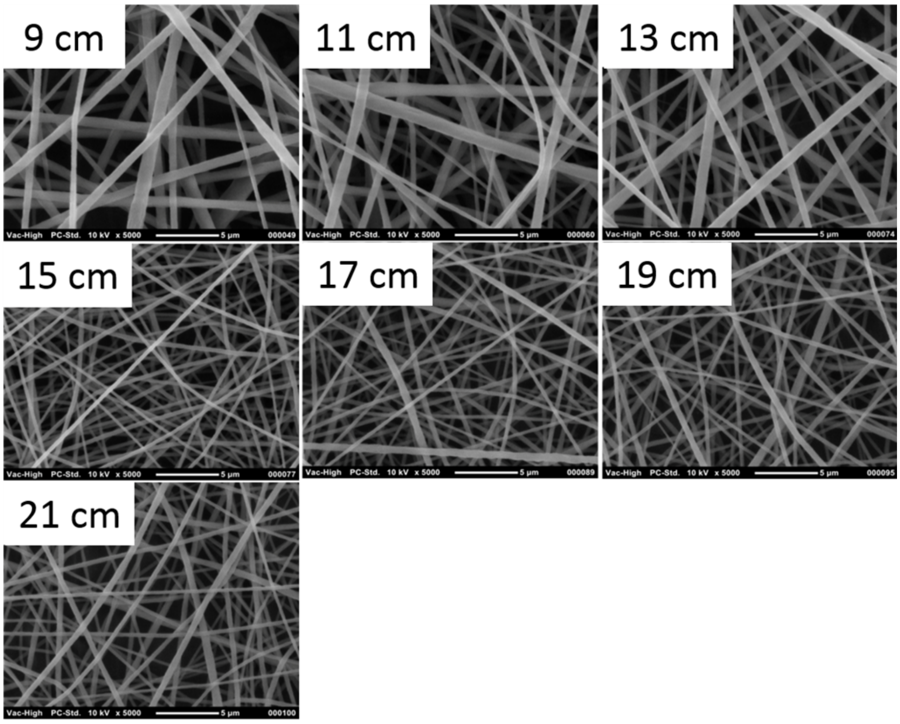

Figure S6 SEM images of the PVDF nanofibers prepared at different spinning distances (Solution concentration: 20%; Applied voltage: 15 kV; Nanofiber web thickness: 100 μm)

S7 XRD result of the PVDF nanofiber webs prepared at different spinning distances

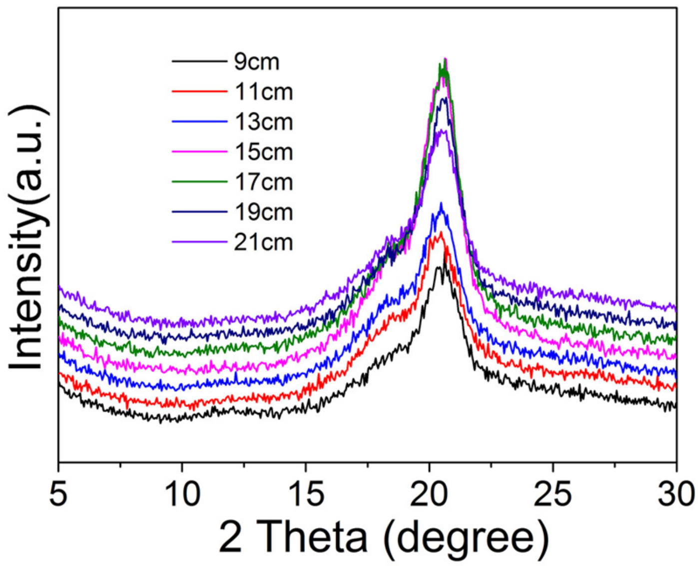

Figure S7 XRD curves of the PVDF nanofiber webs prepared at different spinning distances (Solution concentration: 20%; Applied voltage: 15 kV; Nanofiber web thickness: 100 μm)

S8 FTIR result of the PVDF nanofiber webs prepared at different spinning distances

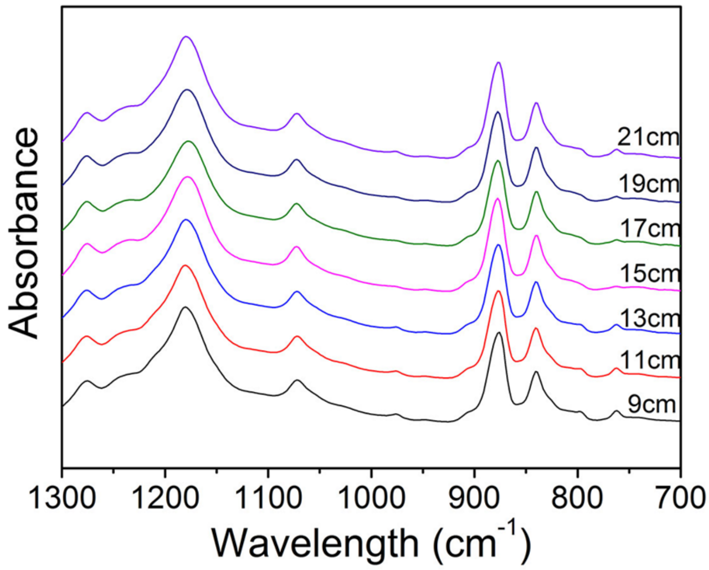

Figure S8 FTIR spectra of the PVDF nanofiber webs prepared at different spinning distances

(Solution concentration: 20%; Applied voltage: 15 kV; Nanofiber web thickness: 100 μm)

S9 Electrical outputs of the PVDF nanofiber webs prepared at different spinning distances

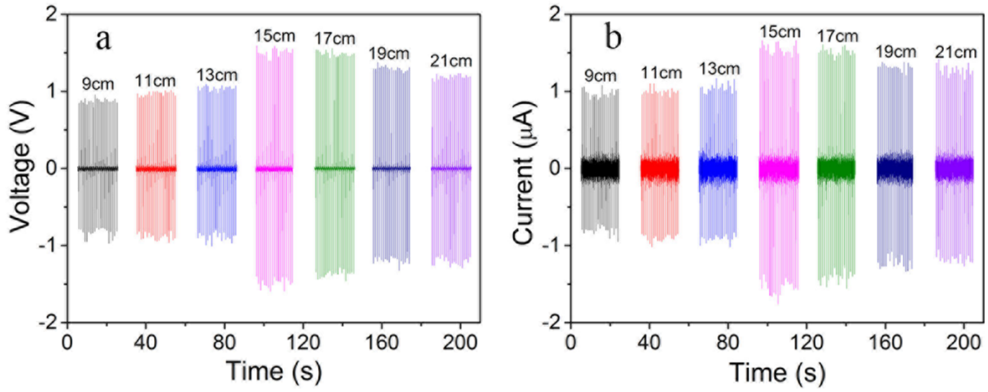

Figure S9 Voltage and current outputs of the PVDF nanofiber webs prepared at different spinning distances (Solution concentration: 20%; Compression force: 10N; Frequency: 1 Hz; Applied voltage: 15 kV; Nanofiber web thickness: 100 μm)

S10 Morphology of the PVDF nanofibers prepared at a constant electric field intensity

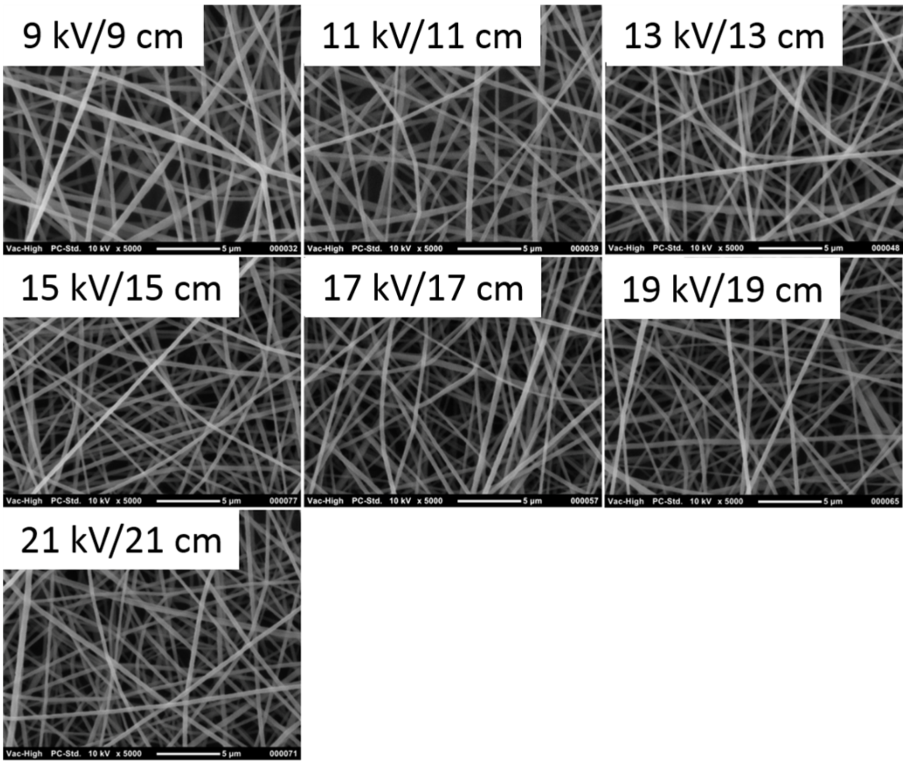

Figure S10 SEM images of the PVDF nanofibers prepared at a constant electric field intensity (Solution concentration: 20%; Nanofiber web thickness: 100 μm)

S11 XRD result of the PVDF nanofiber webs prepared at a constant electric field intensity

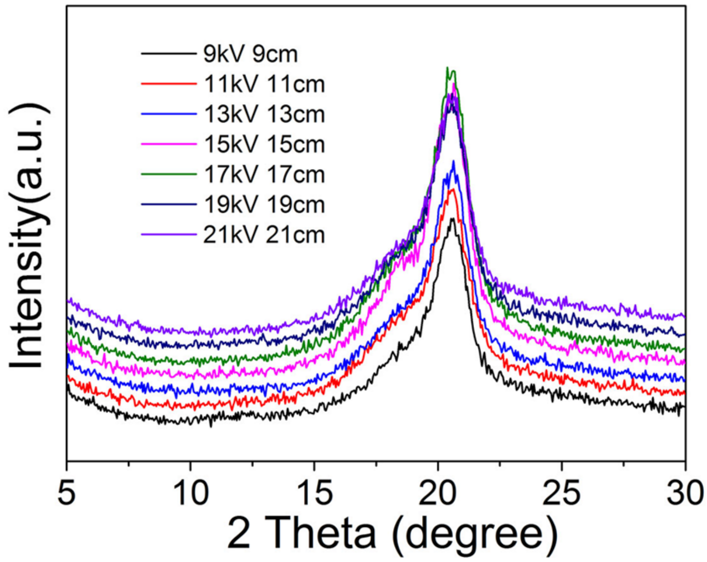

Figure S11 XRD curves of the PVDF nanofiber webs prepared at a constant electric field intensity (Solution concentration: 20%; Nanofiber web thickness: 100 μm)

S12 FTIR result of the PVDF nanofiber webs prepared at a constant electric field intensity

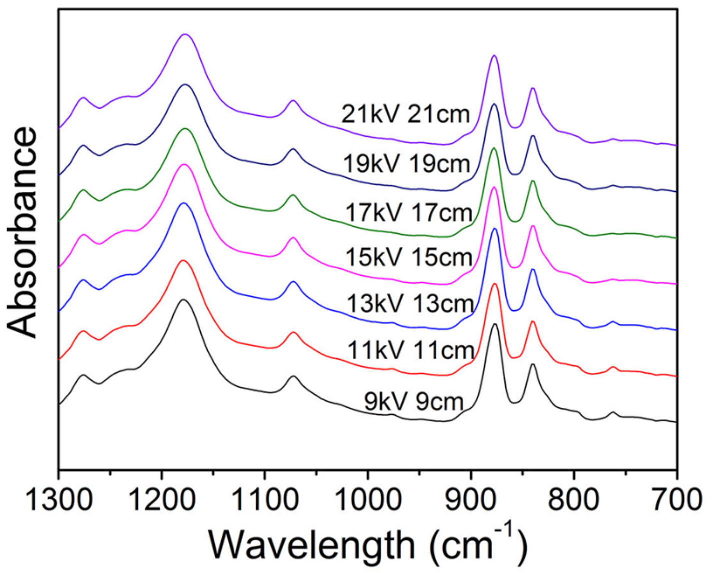

Figure S12 FTIR spectra of the PVDF nanofiber webs prepared at a constant electric field intensity (Solution concentration: 20%; Nanofiber web thickness: 100 μm)

S13 Electrical outputs of the PVDF nanofiber webs prepared at a constant electric field intensity

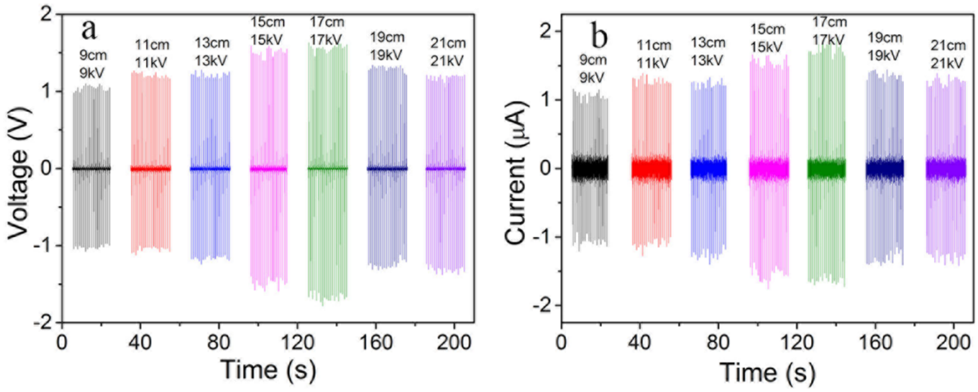

Figure S13 Voltage and current outputs of the PVDF nanofiber webs prepared at a constant electric field intensity (Solution concentration: 20%; Compression force: 10N; Frequency: 1 Hz; Nanofiber web thickness: 100 μm)

S14 Electrical outputs of the PVDF nanofiber webs with different thicknesses

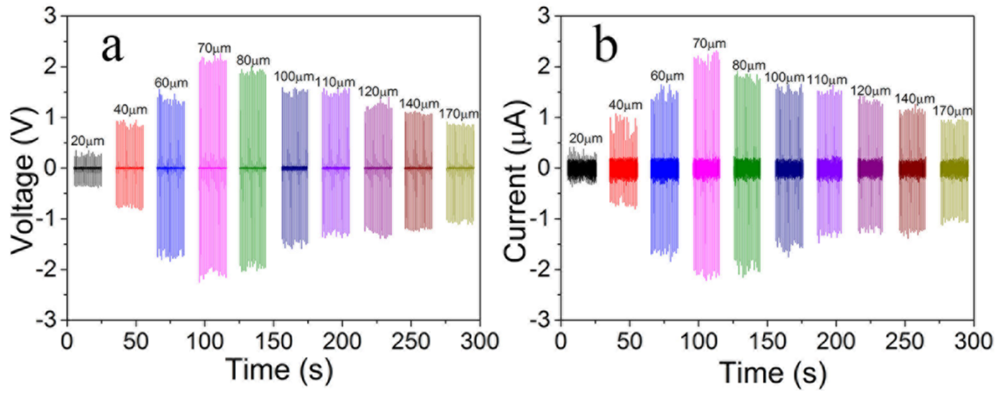

Figure S14 Voltage and current outputs of the PVDF nanofiber webs with different thicknesses (Solution concentration: 20%; Compression force: 10N; Frequency: 1 Hz; Applied voltage: 15 kV; Spinning distance: 15 cm)

S15 Chain conformations of different PVDF crystal phases

α

β

γ

δ

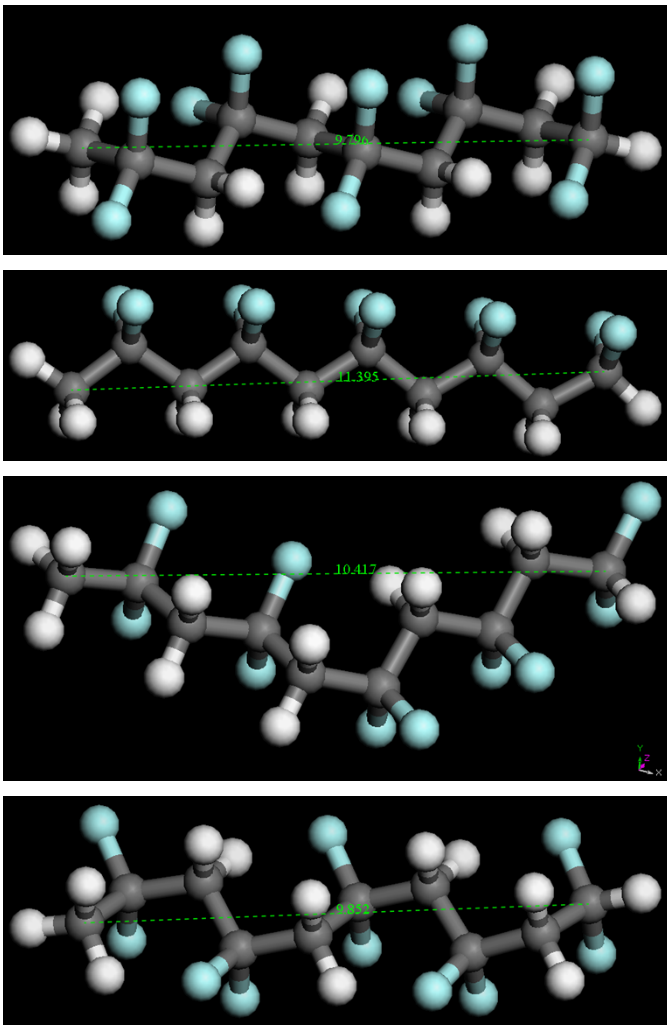

Figure S15 Chain conformations of different PVDF crystal phases and distance between C1 and C10. The geometries were optimized by Molecular Studio 3.0 using DMol[3] (GGA/BLYP/DND). The distances marked are in Å.

Table S1 Chain length of a PVDF segment (10 carbon atoms) in different conformations.

Crystal phase	Chain length (Å)	
	DFT method	From cell dimension
α	9.796	11.55
β	11.395	12.80
γ	10.417	11.50
δ	9.895	11.55

Table S2 Unit cell dimension of different PVDF crystal phases [1-3]

Crystal phase	Unit cell (nm) *a*	*b*	*c*
α and δ (4 carbon atoms/unit)	0.496	0.964	0.462
β (2 carbon atoms/unit)	0.847	0.490	0.256
γ (8 carbon atoms/unit)	0.496	0.967	0.920

The column *c* in Table S2 represents the molecular chain unit length of different crystal phases. It can be used to calculate chain length. Both calculations indicate that main chain length in β crystal phase is the longest among all the conformations.

References

[1] R. Hasegawa, Y. Takahashi, Y. Chatani, and H. Tadokoro, "Crystal Structures of Three Crystalline Forms of Poly(vinylidene fluoride)," *Polym J*, vol. 3, no. 5, pp. 600-610, 1972.
[2] H. R. Gallantree, "Review of transducer applications of polyvinylidene fluoride," *Solid-State and Electron Devices, IEE Proceedings I*, vol. 130, no. 5, pp. 219-224, 1983.
[3] E. Erdtman, K. C. Satyanarayana, and K. Bolton, "Simulation of α- and β-PVDF melting mechanisms," *Polymer*, vol. 53, no. 14, pp. 2919-2926, 2012.