

Support Information

Enhancing sound insulation of glass interlayer film by introducing piezoelectric fibers

*Donghe Chen, Shuo Zheng, Mingyu Jing, Zaiqian Yu, Jiawei Zhang, Longjiao Yu, Shulin
Sun and Shiwei Wang**

School of Chemical Engineering, Advanced Institute of Materials Science, Changchun
University of Technology, Changchun 130012, P. R. China.

E-mail: wswjldx2004@163.com

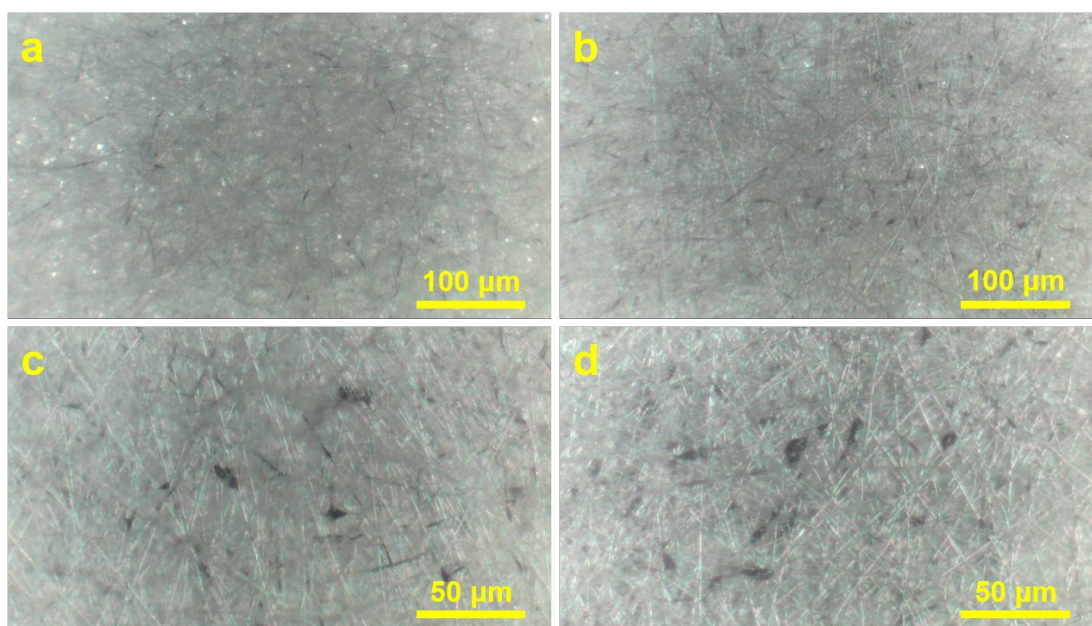


Fig. S1 Optical microscope images of the electrospun PVDF membranes with (a) 0.1 wt%, (b) 0.3 wt%, (c) 0.5 wt% and (d) 1.0 wt% MWCNTs.

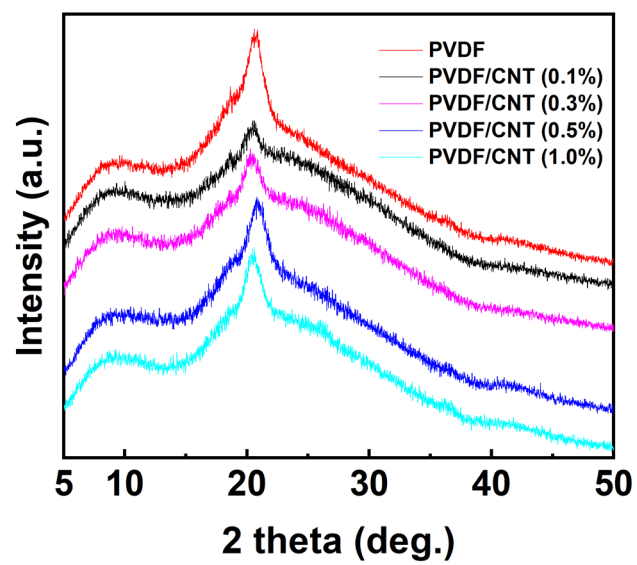


Fig. S2 XRD patterns for electrospun pure PVDF and PVDF/MWCNTs membrane with different MWCNTs loads.

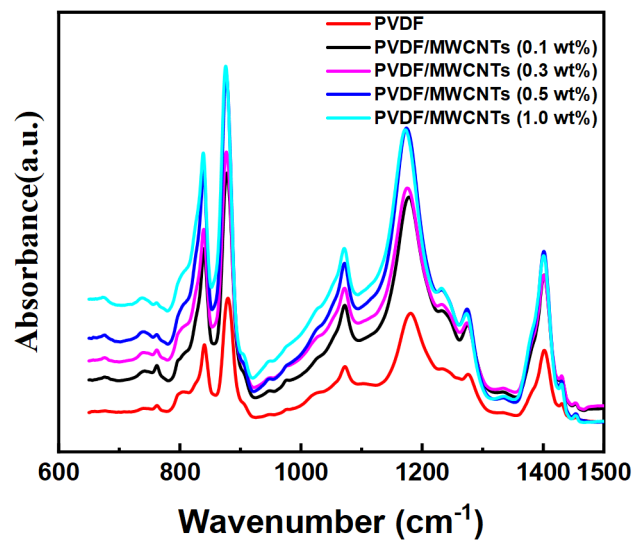


Fig. S3 Complete FTIR spectra of electrospun PVDF and PVDF/MWCNTs membranes.

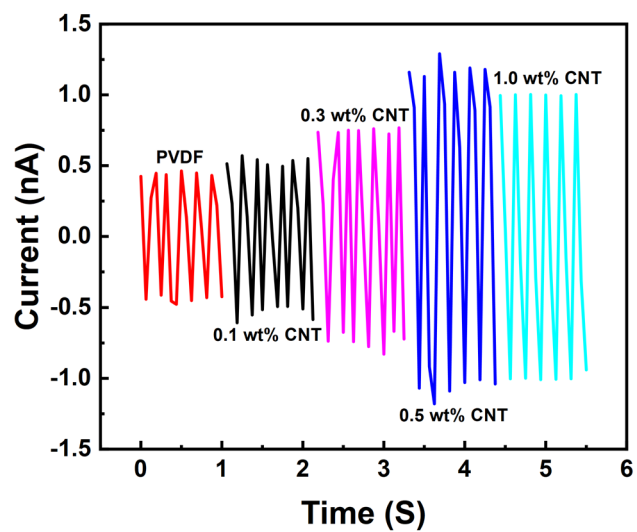


Fig. S4 The output current for the electrospun PVDF/MWCNTs membranes.

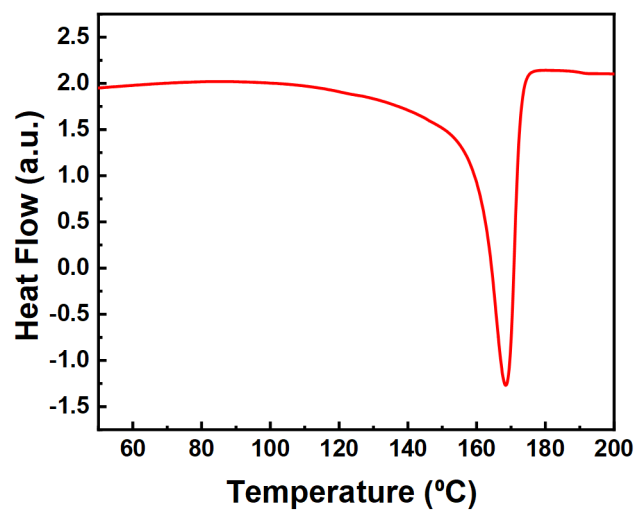


Fig. S5 DSC thermogram of electrospun PVDF nanofiber membrane.

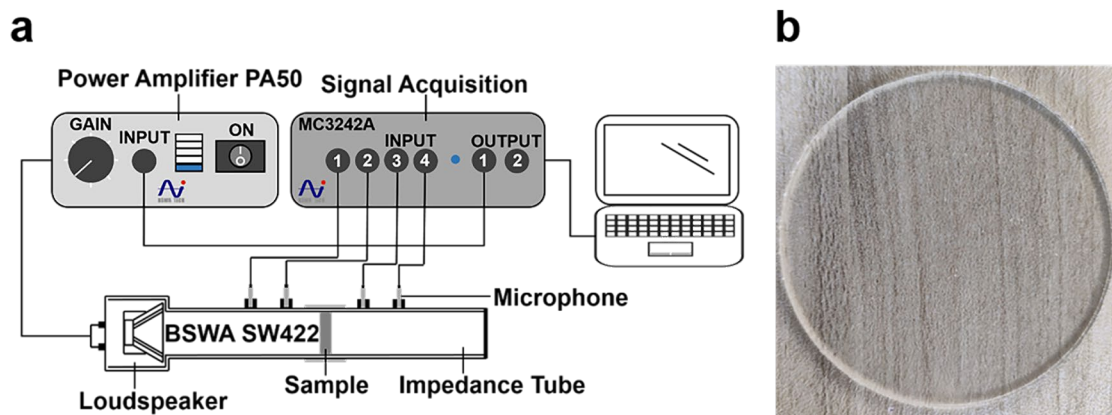


Fig. S6 (a) Acoustical measurement system and (b) The image of the composite film for impedance detection.

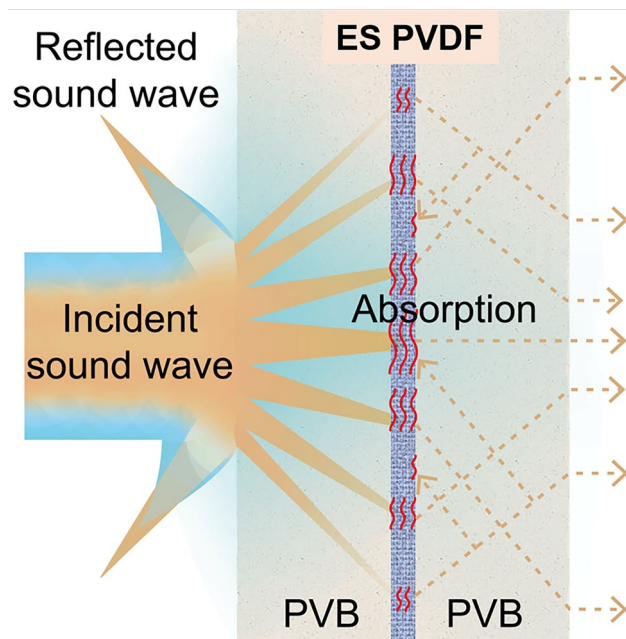


Fig. S7 Sound insulation mechanism of PVB in composite film.

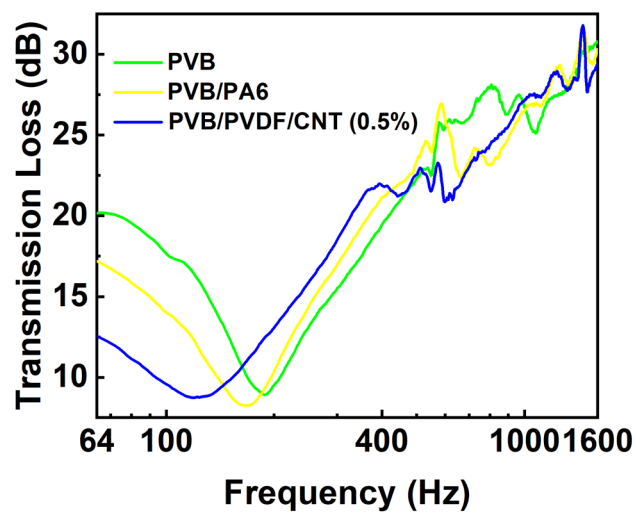


Fig. S8 Comparison of transmission loss of pure PVB film, PVB/PVDF composite film and PVB/PA6 composite film.

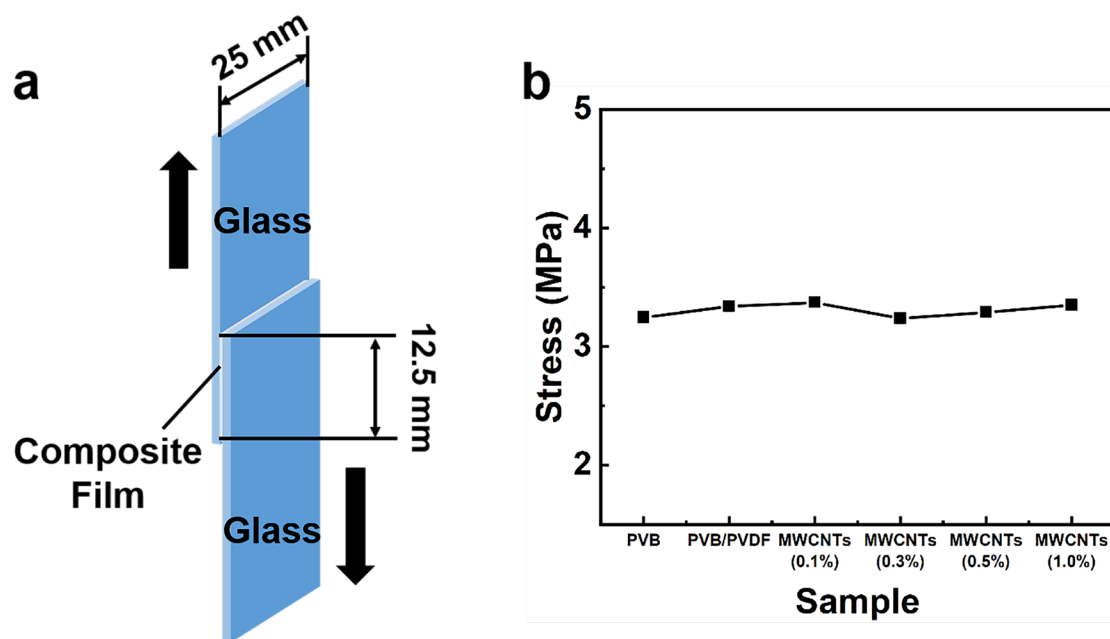


Fig. S9 (a) Shear test diagram and (b) Comparison of shear strength of PVB/PVDF composites with different MWCNTs loads and PVB laminated glass.

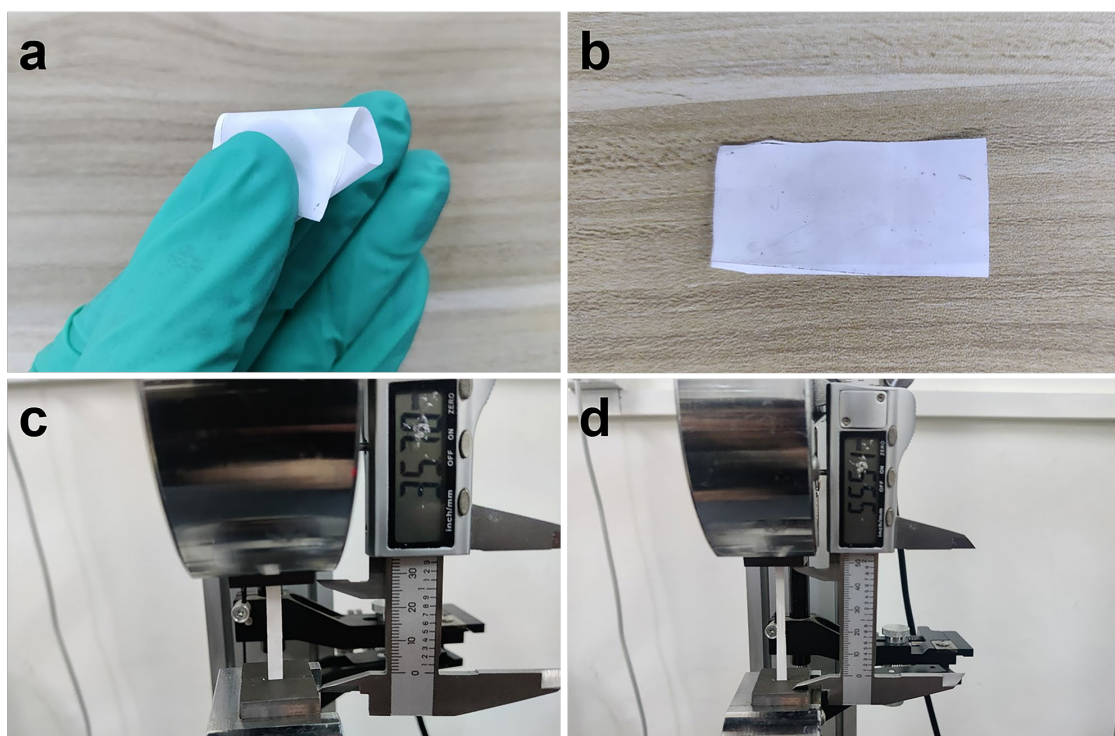


Fig. S10 The images of PVDF fiber membrane after hot pressing (a) during bending, (b) after bending, (c) before stretching and (d) after stretching.

Table S1 Measurement of specific surface area and porosity of electrospun PVDF and PVDF/MWCNTs membranes.

	BET Surface Area (m ² /g)	Pore Volume (cm ³ /g)	Pore Size (Å)
PVDF	4.3447	4.73×10 ⁻⁴	4.3528
PVDF/MWCNTs (0.1%)	3.7870	2.82×10 ⁻⁴	2.9835
PVDF/MWCNTs (0.3%)	0.0644	2.2×10 ⁻⁵	13.4629
PVDF/MWCNTs (0.5%)	0.0201	1.1×10 ⁻⁵	21.7710
PVDF/MWCNTs (1.0%)	0.0110	3.3×10 ⁻⁵	119.6159

Table S2 Transmission loss of PVB/PVDF composite films with different loadings of MWCNTs at different frequencies.

Sample	200 Hz (dB)	300 Hz (dB)	400 Hz (dB)	500 Hz (dB)
PVB	9.5	15.5	19.4	22.3
PVB/PVDF	11.8	17.8	21.4	22.7
PVB/PVDF/MWCNTs (0.1 wt%)	12.7	18.0	22.1	23.8
PVB/PVDF/MWCNTs (0.3 wt%)	13.0	18.2	21.6	22.0
PVB/PVDF/MWCNTs (0.5 wt%)	13.1	18.5	21.9	22.5
PVB/PVDF/MWCNTs (1.0 wt%)	12.2	17.9	21.8	23.5

Table S3 The breakage rate of all laminated glass with different interlayers.

Sample	PVB	PVB/PVDF	PVB/PVDF (0.1 wt%)	PVB/PVDF (0.3 wt%)	PVB/PVDF (0.5 wt%)	PVB/PVDF (1.0 wt%)
Breakage Rate (%)	2.8	2.6	2.7	2.6	2.7	2.5