Supplementary Information (SI) for Journal of Materials Chemistry C.

Supplementary Information of

Achieving Superior High-Temperature Energy Storage Performance in Polycarbonate via Small Molecular Traps and Hydrogen Bonding

Yu Feng,[ab] Yongzhe Yu,[ab] Yu Teng,[ab] Jun Sun,[ab] Yuanhang Yao,[ab] Wenchao Zhang,[ab] Xiaoming Wang [c] and Dong Yue *[ab]

a. Key Laboratory of Engineering Dielectrics and Its Application, Ministry of Education, Harbin University of Science and Technology, Harbin, China.
b. School of Electrical and Electronic Engineering, Harbin University of Science and Technology, Harbin, China. E-mail: yuedong@hrbust.edu.cn.
c. School of Material Science and Chemical Engineering, Harbin University of Science and Technology, Harbin 150080, China.

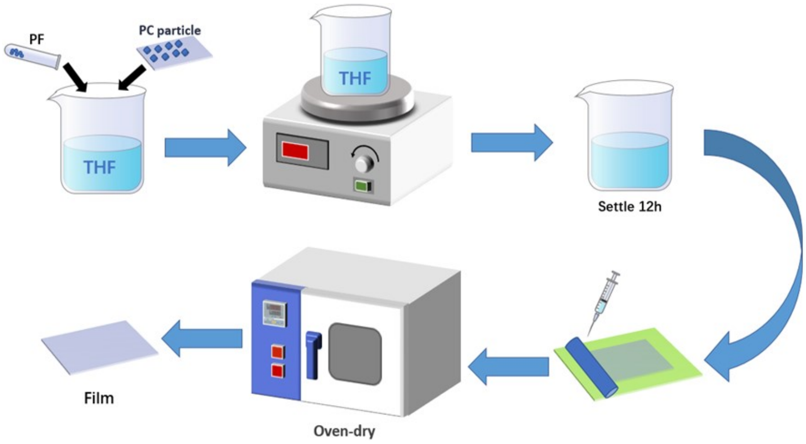

Fig.S1 Schematic illustration of the preparation process for PF/PC composite dielectric thin films

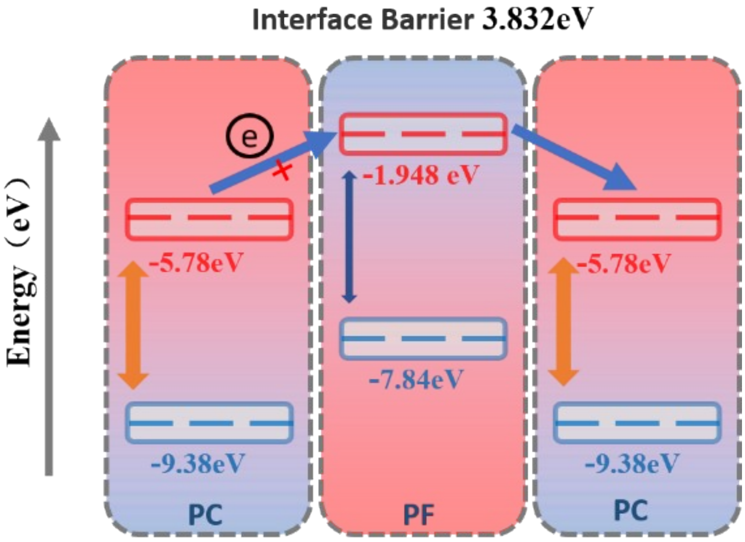

Fig.S2 Energy level alignment diagram of PF and PC

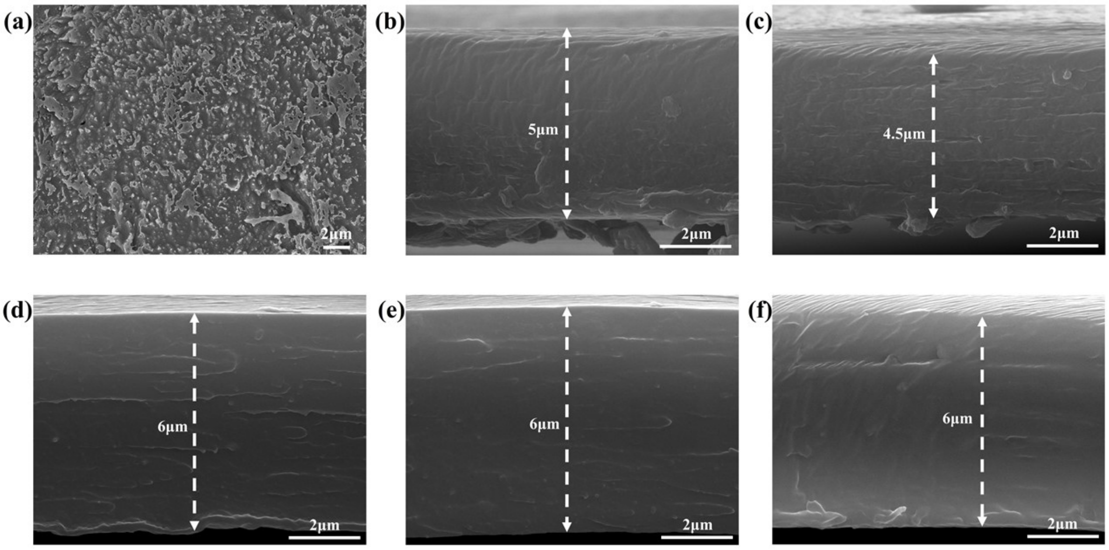

Fig.S3 (a) Morphology of PF (b) Cross-sectional image of pure PC (c) Cross-sectional image of 0.5 wt% PF/PC (d) Cross-sectional image of 1 wt% PF/PC (e) Cross-sectional image of 1.5 wt% PF/PC; (f) Cross-sectional image of 2 wt% PF/PC

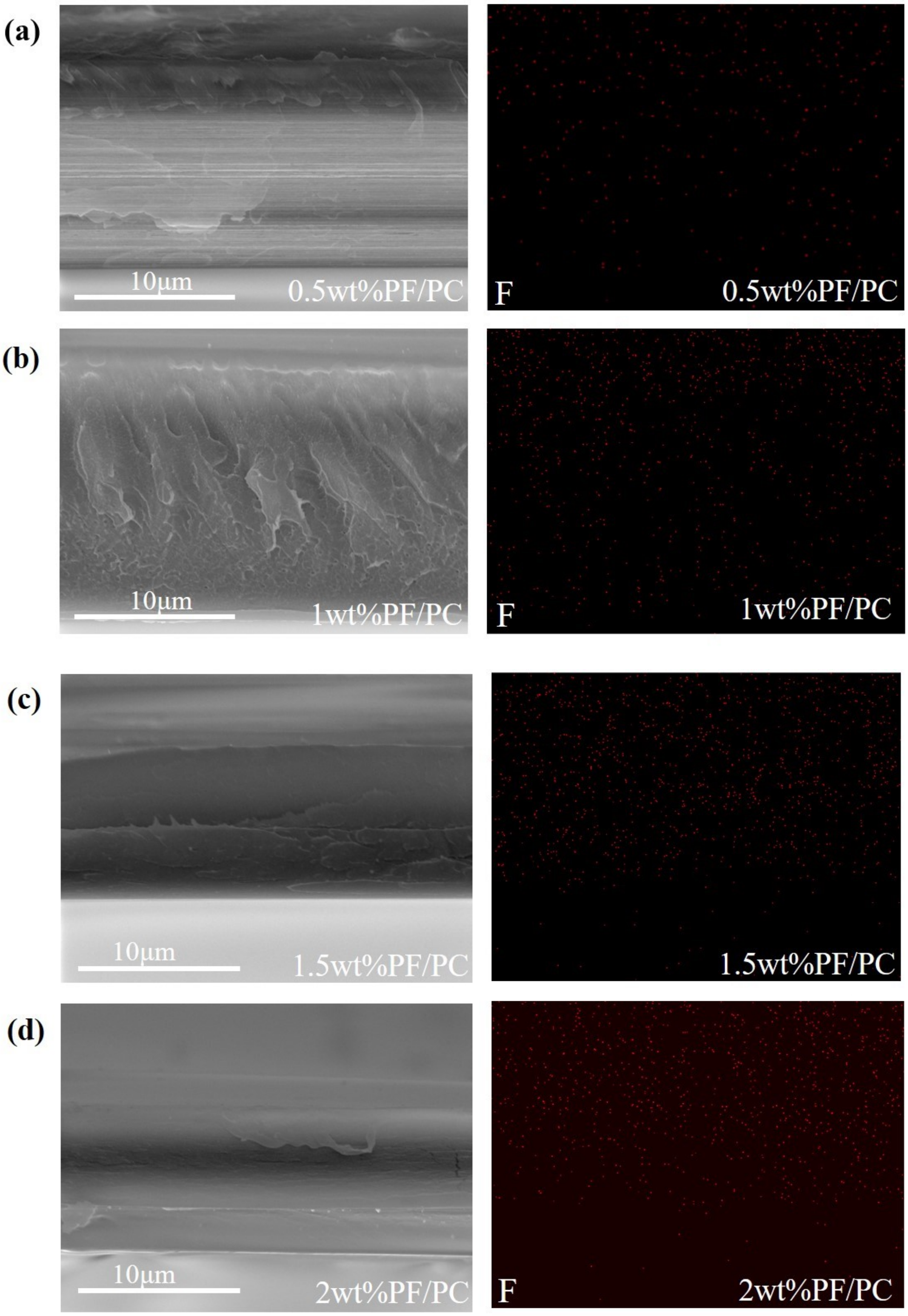

Fig.S4 (a) F element distribution in the cross-section of 0.5 wt% PF/PC (b) F element distribution in the cross-section of 1 wt% PF/PC (c) F element distribution in the cross-section of 1.5 wt% PF/PC (d) F element distribution in the cross-section of 2 wt% PF/PC

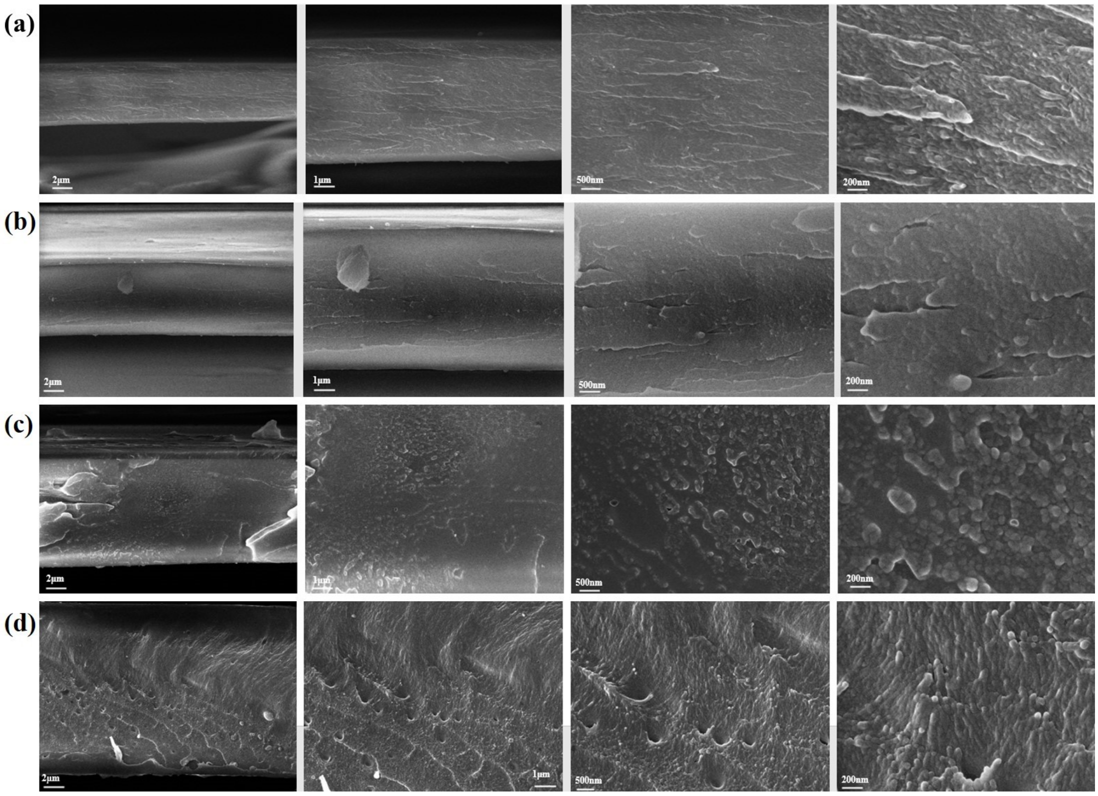

Fig.S5 (a) Microscopic SEM image of 0.5wt% PF/PC; (b) Microscopic SEM image of 1wt% PF/PC; (c) Microscopic SEM image of 1.5wt% PF/PC; (d) Microscopic SEM image of 2wt% PF/PC

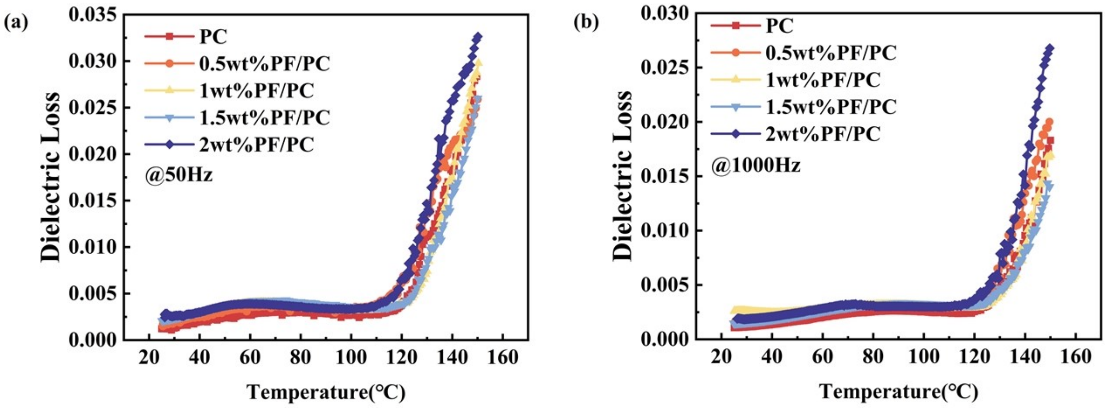

Fig.S6 (a) Dielectric loss versus temperature for PF/PC at 50 Hz. (b) Dielectric loss versus temperature for PF/PC at 1000 Hz.

The Weibull function is utilized to model the relationship between the probability of breakdown and the average breakdown field strength.

$$P(E) = 1 - \exp\left[-\left(\frac{E}{E_b}\right)^{\beta}\right]\#(6)$$

where $P(E)$ denotes the cumulative failure probability, E represents the breakdown field strength, E_b is the characteristic breakdown field strength (defined as the electric field at which the cumulative failure probability $P(E)$ reaches 63.2%), and β is the shape parameter.

A Fitted Model of Saltatory Conduction

$$J = n_c 2uve \times e^{\frac{-W_a}{K_B T}} \times \sinh\left(\frac{\lambda_e E}{2K_B T}\right)\#(7)$$

In this equation, n_c denotes the carrier concentration, λ represents the hopping distance, v is the attempt or escape frequency, W_a indicates the activation energy in electron volts (eV), e is the elementary charge, T denotes the temperature, and K_B is the Boltzmann constant. This expression can be simplified to yield Equation (8).

$$J = A \times \sinh\left(B \times E\right)\#(8)$$

A and B denote lumped parameters.

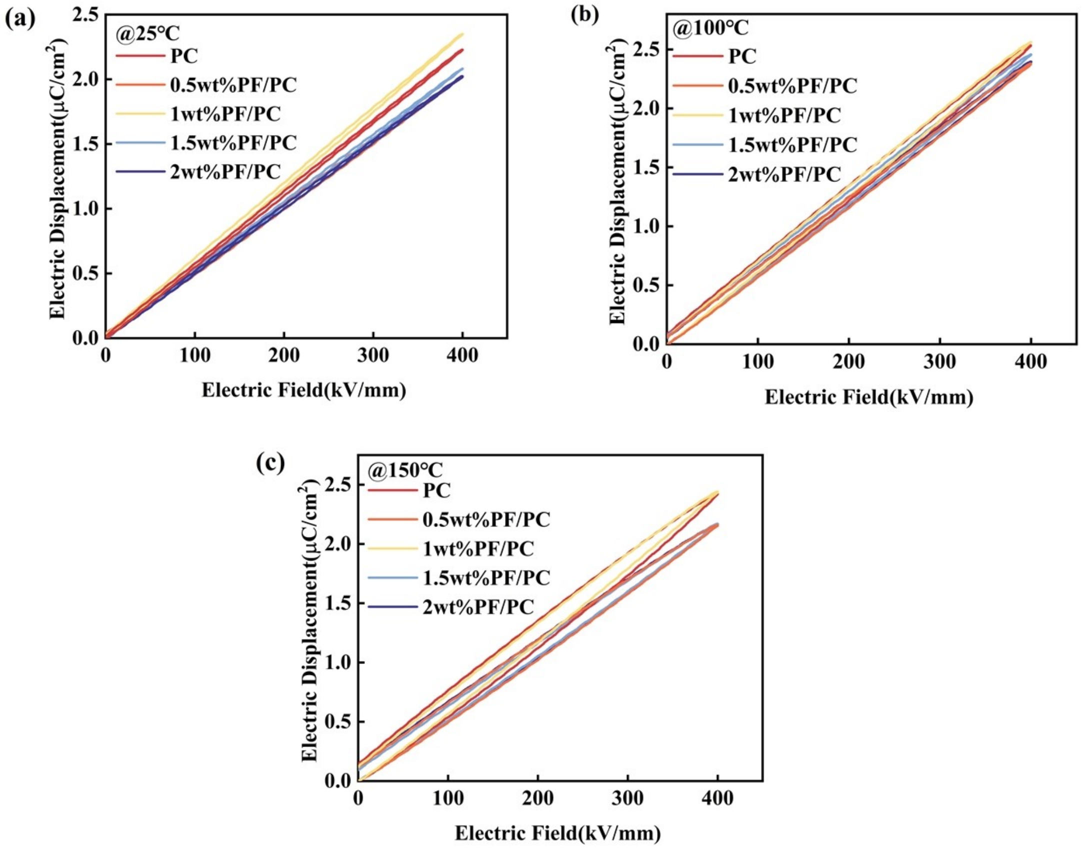

Fig.S7 (a) *D*-*E* curve at 25 °C (b) *D*-*E* curve at 100 °C (c) *D*-*E* curve at 150 °C

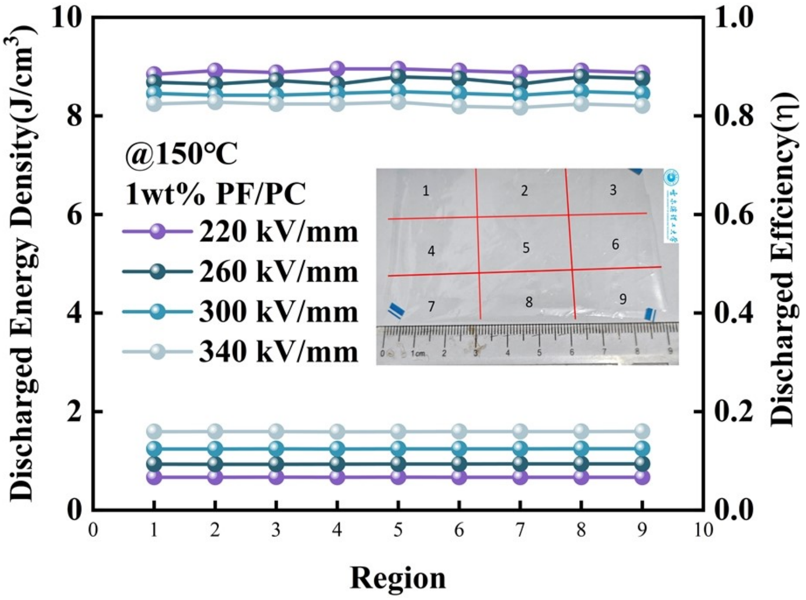

Fig. S8 Uniformity assessment of another batch of 1 wt% PF/PC composite at 150 °C

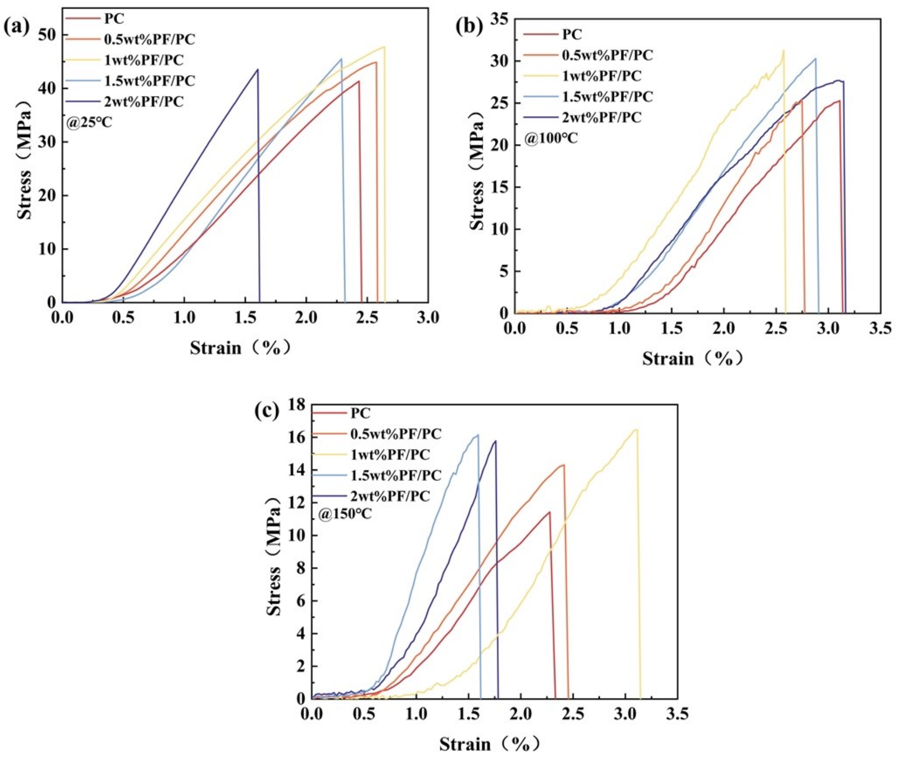

Fig.S9 (a) Stress-strain curve at 25 °C (b) Stress-strain curve at 100 °C (c) Stress-strain curve at 150 °C