Electronic Supplementary Material (ESI) for Soft Matter.

Programming Shape and Tailoring Transport: Advancing Hygromorphic Bilayers with Aligned Nanofibers

Symone L. M. Alexander, Shadi Ahmadmehrabi, and LaShanda T. J. Korley*

Department of Macromolecular Science and Engineering, Case Western Reserve University

Cleveland, Ohio 44106-7202, United States

*Ph: (216) 368-1421, email lashanda.korley@case.edu

SUPPLEMENTAL INFORMATION

Supplemental Videos:

Hygromorphic Curvature of Bilayers:

Supplemental Video 1 (SV1):

Description: Natural curvature of bilayer composite with vertically-aligned PVA nanofibers

Supplemental Video 2 (SV2):

Description: Natural curvature of bilayer composite with horizontally-aligned PVA nanofibers

Supplemental Video 3 (SV3):

Description: Natural curvature of bilayer composite with diagonally-aligned PVA nanofibers

Supplemental Video 4 (SV4):

Description: Lifting of weight by horizontally-aligned composite

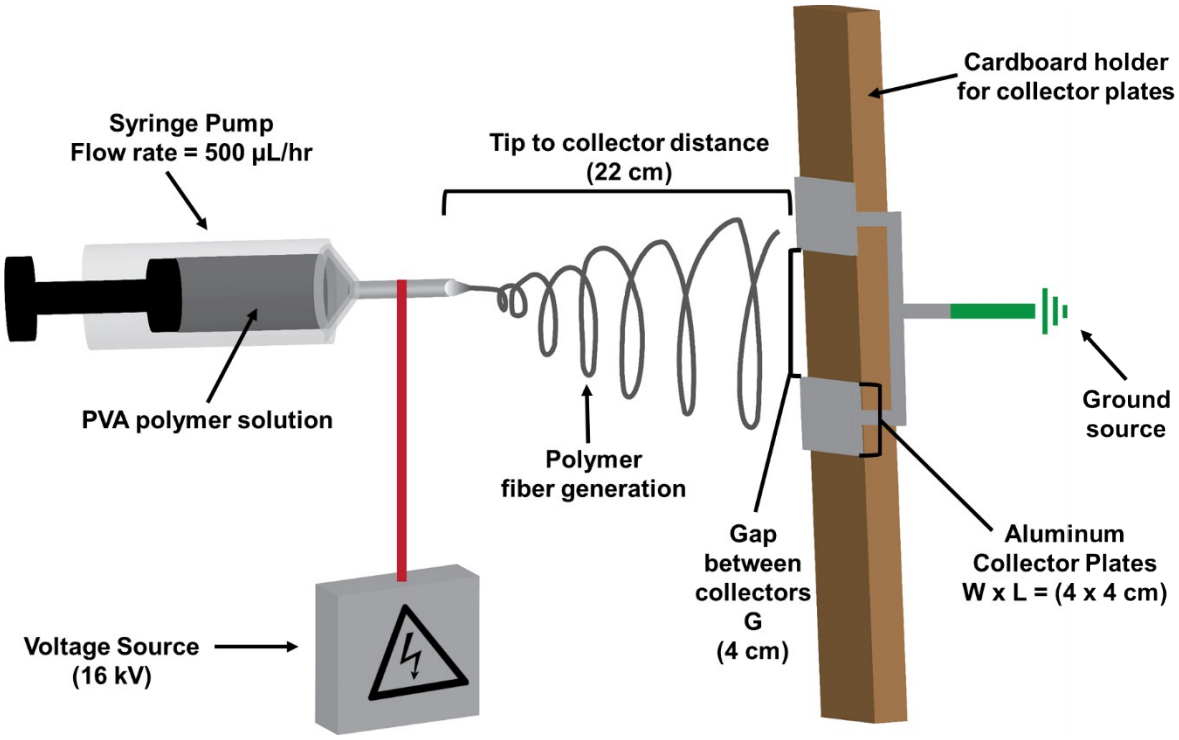

Figure S1: Schematic of parallel plate collector used to obtain aligned nanofibers

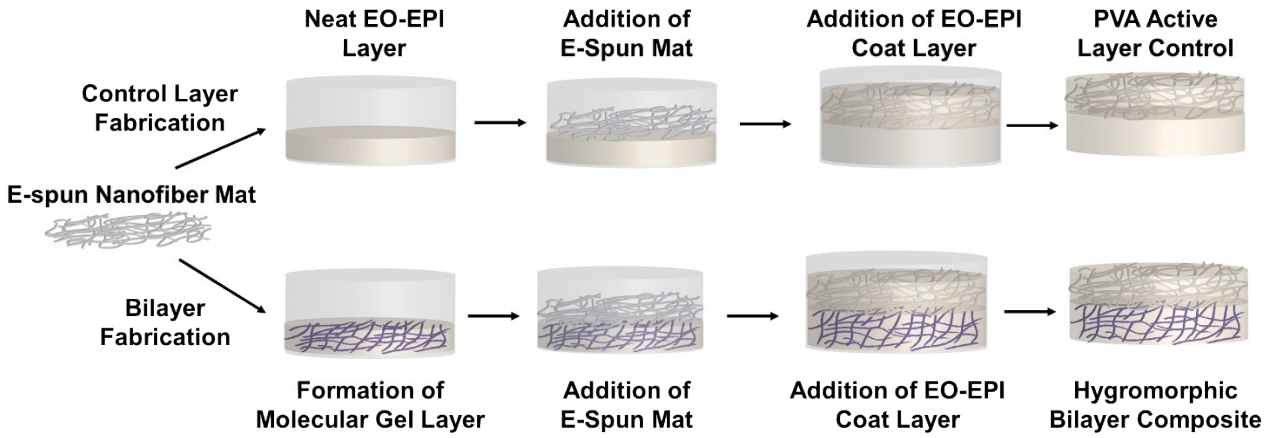

Figure S2: Schematic of Control Active Layers vs. Bilayer Composites

Table S1: Calculated Diffusion Coefficients for Random and Aligned Nanofiber Active Layers

Sample	Thickness, h (m)	Diffusion Coefficient, D (m^2 min^{-1})
EO-EPI + Random PVA Nanofibers	0.00014	**1.56E-11**
EO-EPI + 0° Aligned PVA Nanofibers	0.00011	**1.26E-10**
EO-EPI + 90° Aligned PVA Nanofibers	0.00011	**2.10E-10**
EO-EPI + 45° Aligned PVA Nanofibers	0.00011	**4.09E-11**

Based on a calibration curve, the concentration of dye in each aliquot was determined using UV/Vis spectroscopy. The following equation describes the change in dye concentration with time:

$$\left(\frac{C}{C_o}\right) = \sqrt{\frac{D}{h^2\pi}}\, t^{\frac{1}{2}}$$

where C is the concentration of dye at time t, C_o is the total concentration of dye in the original sample, D is the diffusion coefficient, h is the sample thickness, and t is time in minutes. C/C_o vs. $t^{1/2}$ was plotted to determine the diffusion coefficient from the slope. Due to the initial burst release of the control layers caused by surface dye elution, the slope was determined starting at $t^{1/2} = 5^{1/2}$. The values for C and C_o as a function of time were obtained using the concentrations determined UV/Vis spectroscopy.

Table S2: Layer Properties for Electrospun Nanofiber Mats and Corresponding Control Layers

Sample	E-spun Mat Crystallinity (%)	E-spun Mat Fiber Size (nm)	Layer Thickness (mm)	Layer Expansion Coefficient, α	Layer Young's Modulus, Hydrated (MPa)
Neat EO-EPI	N/A	N/A	0.14 mm	0.6	0.17 ± 0.04
EO-EPI + Random PVA Nanofibers	63 ± 4	571 ± 37	0.12 ± 0.04	1.2	0.12 ± 0.04
EO-EPI + 0° Aligned PVA Nanofibers	64 ± 2	534 ± 24	0.11 ± 0.05	1.4	0.081 ± 0.006
EO-EPI + 90° Aligned PVA Nanofibers	64 ± 2	534 ± 24	0.11 ± 0.05	1.4	0.076 ± 0.001
EO-EPI + 45° Aligned PVA Nanofibers	64 ± 2	534 ± 24	0.11 ± 0.05	1.5	0.054 ± 0.011