SUPPLEMENTARY INFORMATION

Nucleator Induced Highly Oriented Crystalline Structure of Poly(lactic acid) Fiber Enables Superior Intrinsic Piezoelectrical and Antibacterial Effect

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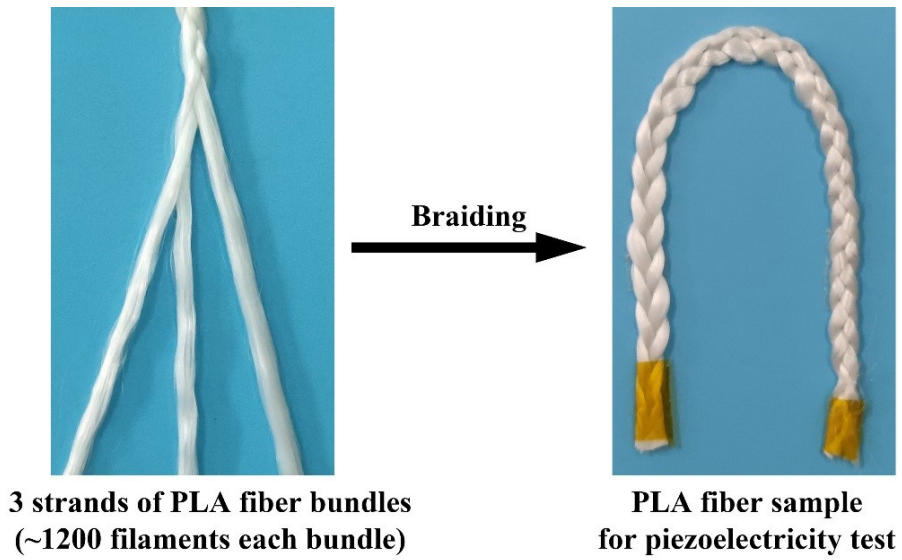Tel: 86-28-85408802

3 strands of PLA fiber bundles
(~1200 filaments each bundle)

Braiding

PLA fiber sample
for piezoelectricity test

Fig.S1 Digital photograph of PLA fiber sample for piezoelectricity test

(a)

Polyimide tape   Copper tape

PLA sample for piezoelectricity testing

PLA sheet   **PLA fiber**   **PLA fabric**

(b)

External force   PLA sample
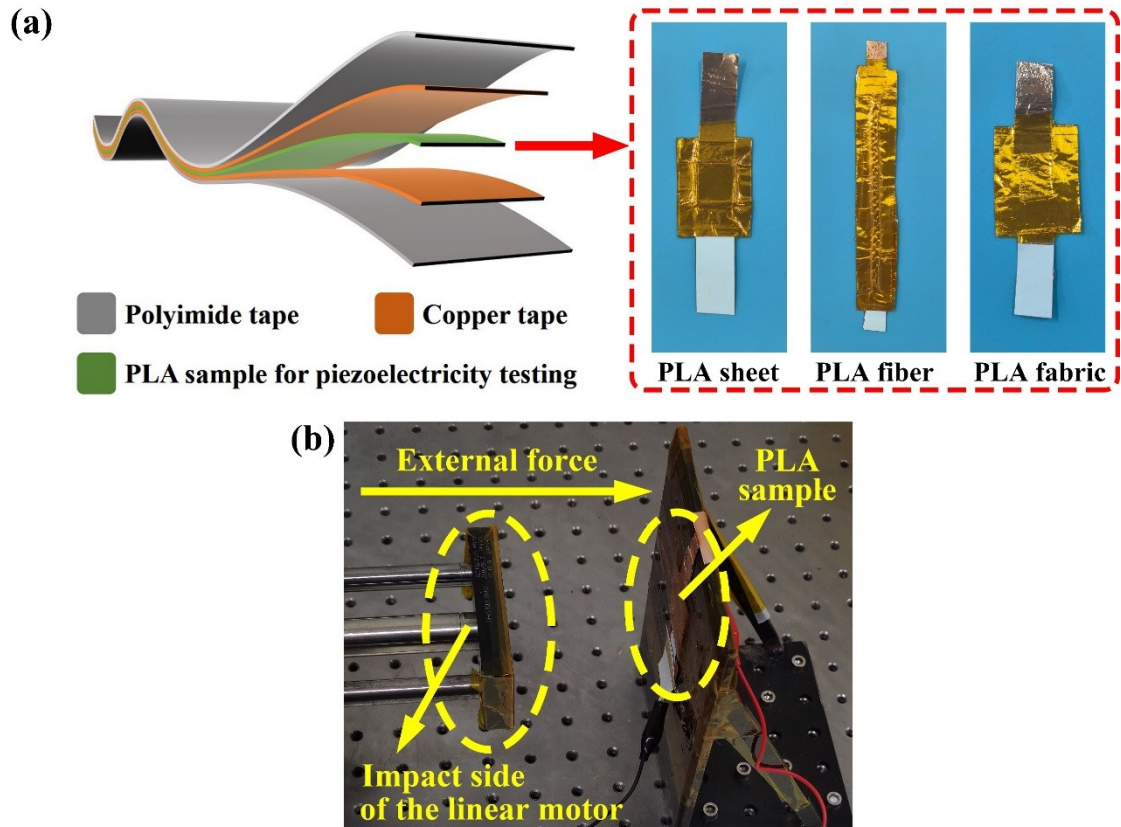
Impact side
of the linear motor

Fig.S2 Schematic diagram and digital photographs of the encapsulated PLA samples (a) and the device (b) for measuring the piezoelectrical output signals
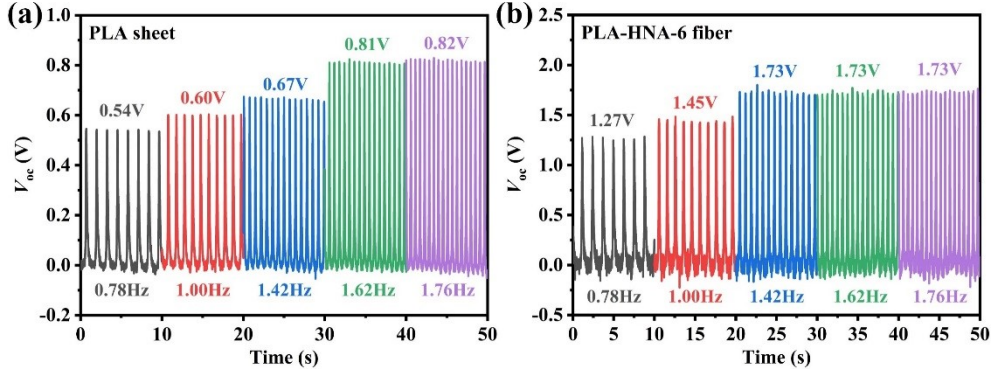
Fig.S3 Dependence of V_{oc} on external applied frequency for PLA sheet (a) and PLA-HNA-6 fiber (b)

Calculation of orientation factor in amorphous region (f_a) via 2D-WAXD analysis

According to the methods reported by Cuculo [1] and Murthy [2, 3], the orientation degree of amorphous region (f_a) for PLA fibers could be calculated as follows. Firstly, the azimuthal angle at the equatorial line was defined as zero degree, and PLA fiber samples were scanned under different azimuths (range from 0~90°). Secondly, peak separation was performed for each curve to obtain diffraction curves of amorphous region, and the area of all curves (A_{amor}) was calculated through integration. Finally, A_{amor} was plotted as the function of azimuthal angle, and the curve was fitted via Gaussian function (S1). Hence the f_a was calculated via equations (S2)-(S3):

$$I(\phi) = \frac{A}{w\sqrt{\pi/2}} e^{-\frac{2\phi^2}{w^2}} \tag{S1}$$

$$f_a = \frac{3 < \cos^2\phi > -1}{2} \tag{S2}$$

$$< \cos^2\phi > = \frac{\int_0^{\frac{\pi}{2}} I(\phi)\cos^2\phi\sin\phi\mathrm{d}\phi}{\int_0^{\frac{\pi}{2}} I(\phi)\sin\phi\mathrm{d}\phi} \tag{S3}$$

where $I(\phi)$ was the fitted value of A_{amor} when the azimuthal angle was ϕ; A was the peak height; w was the full width at half maxima (FWHM) of the peaks.

References

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3   N.S. Murthy, C. Bednarczyk, P.B. Rim, C.J. Nelson, Measurement of amorphous orientation in poly(ethylene terephthalate) fibers by X-ray diffraction and its significance, J. Appl. Polym. Sci. 1997, 64, 1363-1371. https://doi.org/10.1002/(SICI)1097-4628(19970516)64:7<1363::AID-APP16>3.3.CO;2-E.