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Supporting information

Electrospun Strong PCL/PU Composite Vascular Graft with Mechanical Anisotropy and Cyclic Stability

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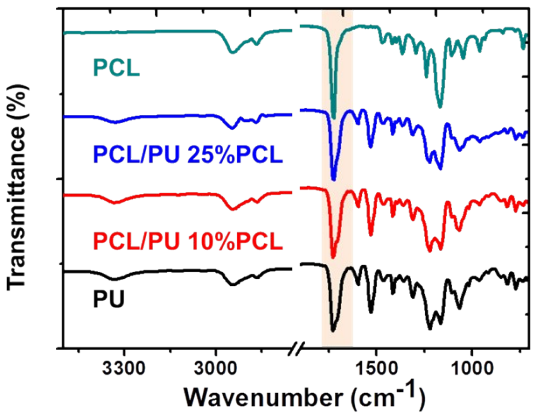

Figure S1. FTIR spectrum of PU, PCL and PCL/PU composite. A set of FTIR spectrum for PU, PCL and PCL/PU in ATR mode was performed to confirm the surface chemistry. A prominent peak at 1728.5 cm-1and 1725.7cm-1 is ascribed to the stretching of C=O in PU and PCL, respectively.

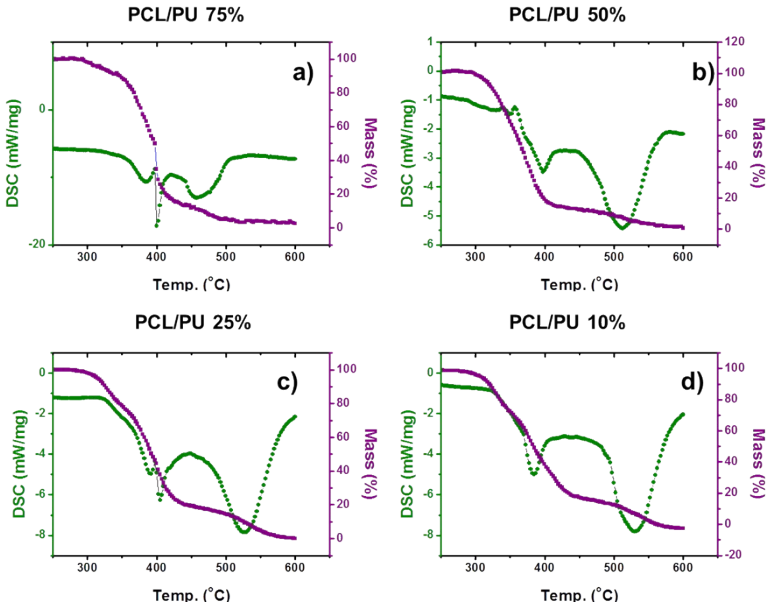

Figure S2. TG-DSC curves of PCL/PU with different PCL contents

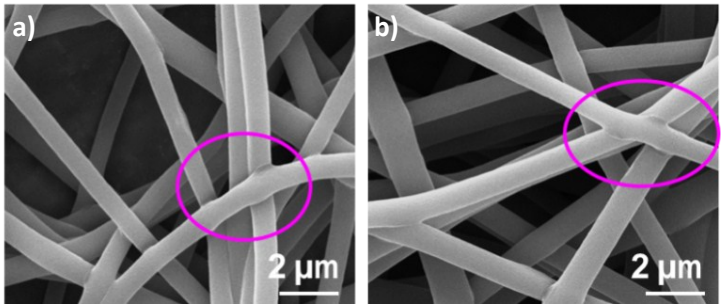

Figure S3. SEM images of PCL/PU composite (a) 25% PCL and (b) 10%PCL showing bonding and intersection between the fibers.

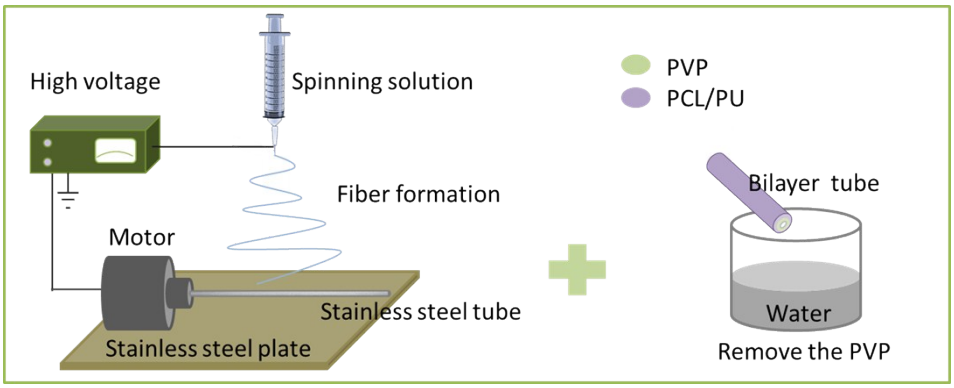

Figure S4. Schematic illustration to the preparation of the small diameter artificial blood vessels: (a) preparation of the bilayer fibrous tube using electrospinning; (b) remove the PVP layer by immersing the tube into water. For purpose of detaching the tubular-shaped scaffold from the mandrel successfully, PVP dissolved in C_2H_5OH was pre-electrospinning onto the mandrel for 5 min followed by electrospinning PCL/PU.

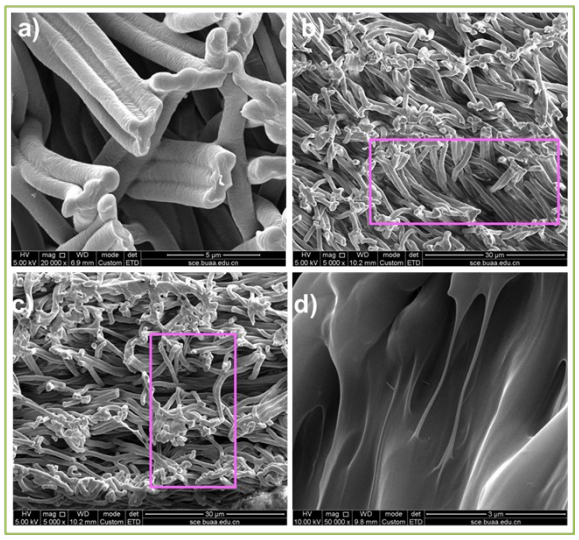

Figure S5. SEM images of cross-section of PCL/PU vascular grafts showing intersecting and stacking between the fibers (a-c) and (d) tensile fracture morphology.

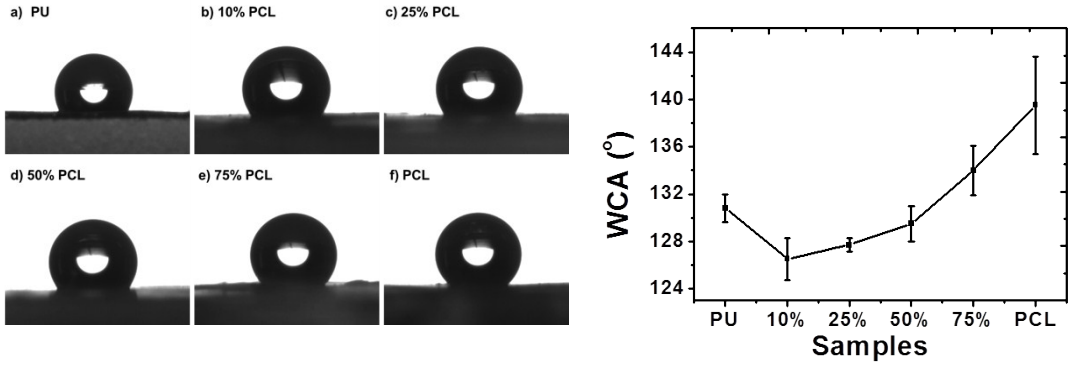

Figure S6. Water droplet on the films and measured CAs of PCL/PU with different ratios reflecting the surface wettability. The contact angle test results show that the as-prepared scaffolds are hydrophobic.

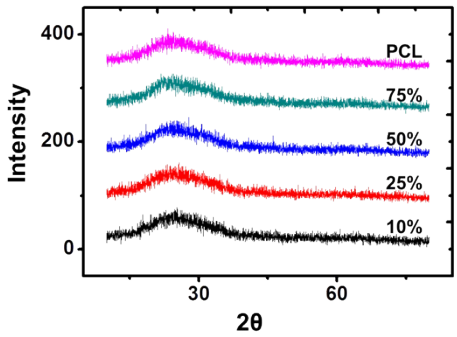

Figure S7. XRD of the electrospinning films with different ratios.

Materials and methods

1.Materials

PU (polyurethane), PCL (polycaprolactone, M_n ~ 70000-90000) and PVP (polyvinylpyrrolidone, M_w ~ 1300000) were purchased from Aldrich. Tetrahydrofuran (THF), N, N-dimethylformamide (DMF) and ethyl alcohol (C_2H_5OH) were purchased from Beijing Chemical Works. For cell proliferation study, mouse fibroblast cells (L929) were purchased from Shanghai Institutes for Biological Sciences, CAS. 3-(4, 5-dimethylth-iazol-2-yl)-2, diphenyl tetrazolium bromide (MTT 98%), fetal bovine serum (FBS), Dulbecco's modified eagle's medium (DMEM) and DMSO were purchased from Sigma.

2. Preparation of fiber films and tubes

For the preparation of precursor solutions, THF and DMF were used as mixed solvent followed by stirring 15 h and ultrasonic treating 10 min. PU, PCL and PCL/PU were dissolved in THF/DMF with the mass ratio of 1:1 and 2:9.5 firstly to form dispersions with the concentration ranging from 8 wt% to 15 wt%. And then the dispersions were directly used in the electrospinning to make membranes. The electrospinning process was performed using a home-made setup including a high voltage power supply, a syringe with stainless steel blunt-ended needle and a rotating mandrel collector. 2 mL solution was added to a 2 mL syringe. The working distances between the needle tip and collector were set 20 cm. The appropriate voltage and inner diameters of the needles were various for the purpose of obtain requirement-meeting fiber films. The stainless steel and hollow mandrels connected with AC synchronous motors (14 W, 220 V, 50 Hz) were used as collector for fabricate vascular graft. For purpose of detaching the tubular-shaped scaffold from the mandrel successfully, PVP dissolved in C_2H_5OH was pre-electrospinning onto the mandrel for 5 min followed by electrospinning PCL/PU. And then, the as-prepared tubes were dried at 55^oC in oven.

3. Characterization of fabrics and vascular grafts

Scanning electron microscopy (SEM) images were taken by the Quanta 250 FEG. In order to ensure the accuracy, Quanta 250 FEG and thickness measuring instrument were used to measure the thickness. Rectangular samples were cut from the PCL/PU tubular scaffolds and their length, width and thickness were accurately measured to calculate the volume (V), while the dry weight of the samples (m) was measured with an analytical balance.

4. Molecular chemical and thermal analyses

IR spectra were collected using Nicolet-iN10MX spectrometer in the ATR mode. Thermal characteristics of the PU, PCL and the blend fibrous films were evaluated by using a STA449F3 TG-DSC apparatus. Samples were heated from 0°C to 600°C at a heating rate of 10°C/min. 3 mg of the sample was put in an aluminum pan for the measurements.

5. Mechanical test of fabrics and vascular grafts

Tensile mechanical properties were evaluated at room temperature (25°C) using a Shimadzu AGS-X Tester with a 100 N force cell at a loading rate of 10 mm/min. For fibrous films, the samples were cut into strips with the length of 30 mm and the width of 10 ± 1 mm. A gauge length of 10 mm was used. While for fiber tubes, the samples were cut into cylinders with the height of 15 mm and the diameter of 5 mm. A gauge length of 5 mm was used. The average values were obtained by measuring at least five samples. And the results of stress-strain curves, strength, modulus and elongation were calculated from load-displacement curves.

6. Cytotoxicity and proliferation of cells on the vascular grafts

In order to verify the cytocompatibility of as-prepared vascular scaffold, the cytotoxicity experiments were carried out using MTT detection method. Cytotoxicity was checked by seeding mouse fibroblast (L929) cell on different scaffolds. Briefly, all samples (1 cm x 1 cm) were sterilized and then placed in the 96-well culture plate with the suspension density of 2000 cells/wells. MTT assay was conducted at 1, 3, 5 and 7 days after cell seeding. The optical density was recorded (n = 5) at 490 nm.