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Supporting Information

# An efficient post-doping strategy creating electrospun conductive nanofibers with multi-functionalities for biomedical applications

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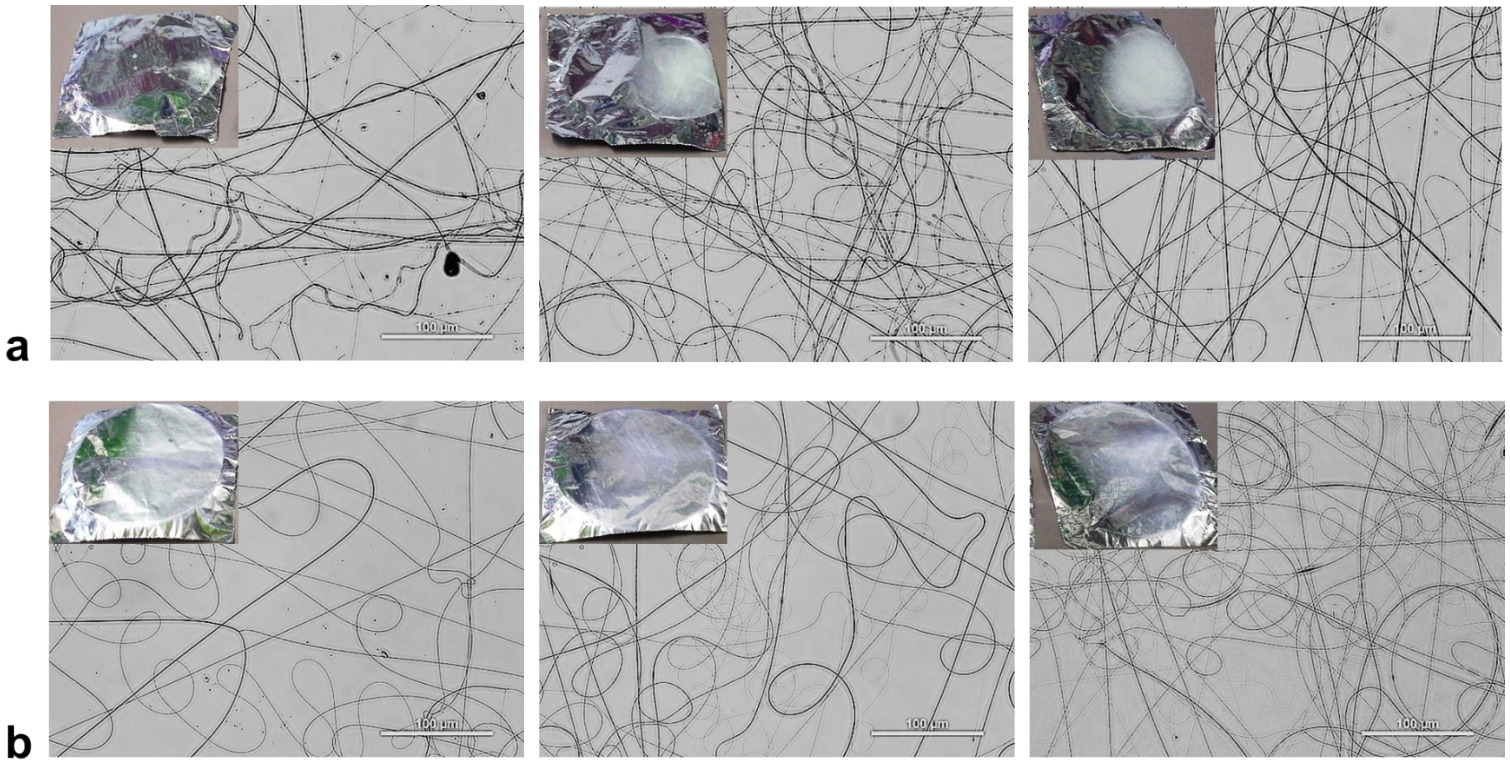


**Fig. S1** Microscopic pictures of individual fibers comparing between ES-PANI/PMMA (a) and EB-PANI/PMMA (b) electrospun at varying relative humidity (~50%, ~40% and ~30% for left, middle, and right images, respectively). Photographic pictures shown in the inset display the corresponding fiber mat. Spinning solutions: 22 % (w/w) ES- or EB PANI in 5 % (w/v) PMMA. Electrospinning conditions: 23-24 °C, feeding rate of 5 µL $min^{-1}$, and 3 min of collecting time. Optimal applied potentials for ES-PANI/PMMA and EB-PANI/PMMA were 10 kV and 15 kV, respectively.

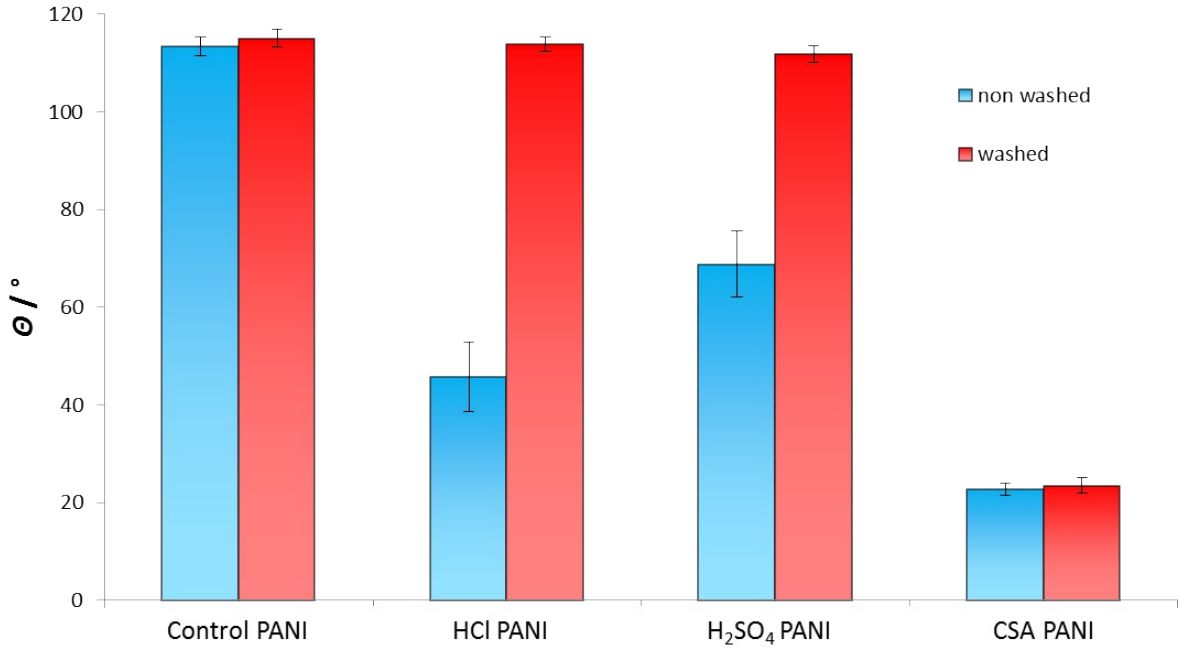


**Fig. S2** Evaluation of binding stability between acids and the nanofibers by water contact angle measurement. Thick fiber mats were collected on ITO electrode (15 min). Incubation with acids (dissolved in water) were carried out for 15 min. The samples were rinsed by water 3 times and blown dry with nitrogen. 5 μL of water was dropped on the samples. (n = 3)

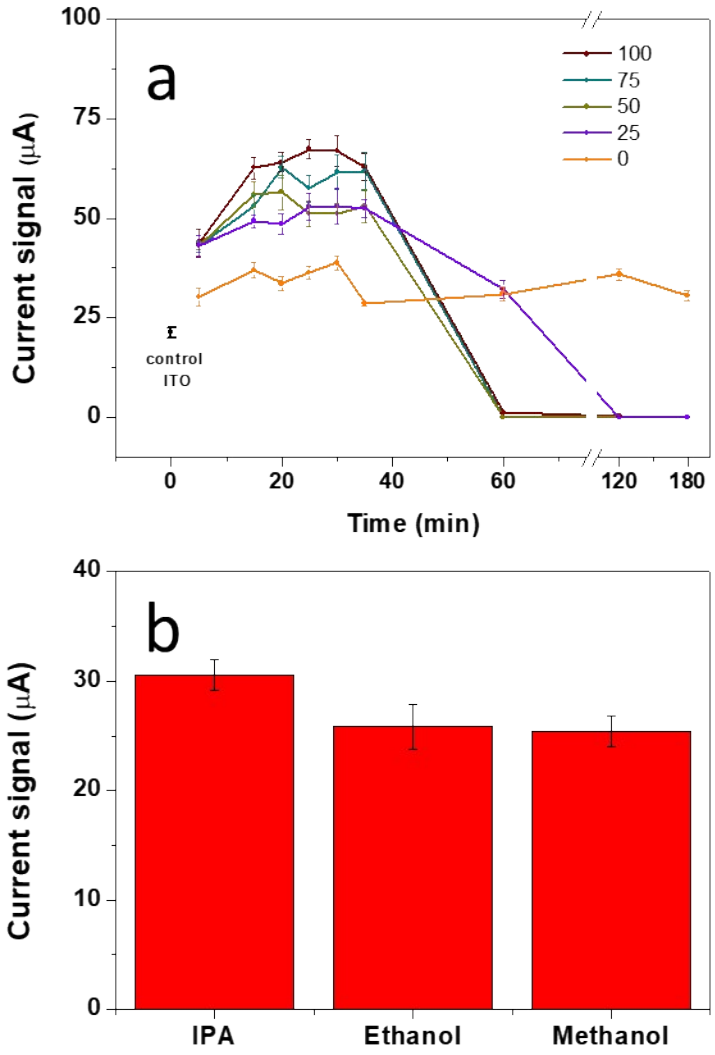


**Fig. S3** Effect of water on ITO etching. (a) Current response over time course of bare ITO electrodes after incubating with 1 M camphorsulfonic acid (CSA) when various percentage of water was varied in isopropyl alcohol (IPA). (b) Current response of ITO after 180-min incubating with CSA dissolved in various type of alcohols. CVs were recorded in 1 mM potassium ferri/ferro hexacyanide solution (in 0.1 M phosphate buffer, pH 7.0, 0.1 M KCl) from -600 mV to +1200 mV and a 50 mV $s^{-1}$ scan rate (n = 3).

**Table S1** Current signal from bare ITO and nanofiber-modified ITO electrodes upon treating with different acids (dissolved in IPA) for 1 h. Data were taken from the first CV cycle measuring in 1 mM potassium ferri/ferro hexacyanide solution (in 0.1 M phosphate buffer, pH 7.0, 0.1 M KCl) from -600 mV to 1200 mV with 50 mV $s^{-1}$ scan rate. ($n \geq 5$)

| Sample | $\bar{I}_{pa}$(ITO) / µA | $\bar{I}_{pa}$(ITO/PANI) / µA | *Signal change** / % |
|---|---|---|---|
| w/o treatment | 14.27 ± 1.1 | 3.31 ± 0.3 | -77 |
| IPA | 12.79 ± 1.2 | 3.54 ± 2.3 | -72 |
| DBSA | 10.18 ± 3.4 | 7.76 ± 0.8 | -24 |
| *p*-TSA | 16.92 ± 1.7 | 19.11 ± 1.9 | 13 |
| CSA | 16.42 ± 1.3 | 24.08 ± 3.0 | 47 |

* % Signal change = $\frac{\bar{I}pa(ITO/PANI) - \bar{I}pa(ITO)}{\bar{I}pa(ITO)} \times 100$

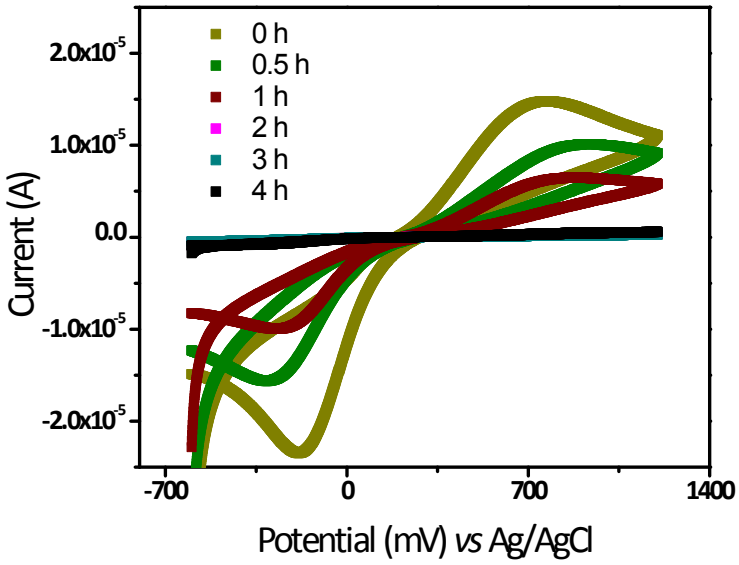


**Fig. S4** Reduction of current signal over time course of EB-PANI nanofibers-modified ITO electrode after treating with IPA. CVs were recorded in 1 mM potassium ferri/ferro hexacyanide solution (0.1 M phosphate buffer, pH 7.0, 0.1 M KCl) from -600 mV to 1200 mV with 50 mV $s^{-1}$ scan rate.

**Table S2** Electrochemical performance of the doped ITO/PANI compared to bare ITO after thermal treatment with various temperatures. Data were taken from the third CV cycles measuring in 1 mM potassium ferri/ferro hexacyanide solution (0.1 M phosphate buffer, pH 7.0, 0.1 M KCl) from -600 mV to 1200 mV with 50 mV $s^{-1}$ scan rate. ($n \geq 5$)

| Sample | *Signal change** / % | *Change of* $\Delta E_p$ ** / % |
|---|---|---|
| Untreated Nanofibers | -40 ± 18 | +12 ± 6 |
| RT | -5 ± 20 | -4 ± 11 |
| 110 °C | -27 ± 14 | -3 ± 6 |
| 120 °C | +8 ± 9 | -15 ± 6 |
| 130 °C | +8 ± 13 | -7 ± 5 |
| 140 °C | +34 ± 12 | -20 ± 5 |

* Signal change (%) $= \frac{\bar{I}pa(ITO/PANI) - \bar{I}pa(ITO)}{\bar{I}pa(ITO)} \times 100$

** $\Delta E_p = E_{pa} - E_{pc}$ ; Change of $\Delta E_p$ (%) $= \frac{\Delta Ep(ITO/PANI) - \Delta Ep\,(ITO)}{\Delta Ep(ITO)} \times 100$

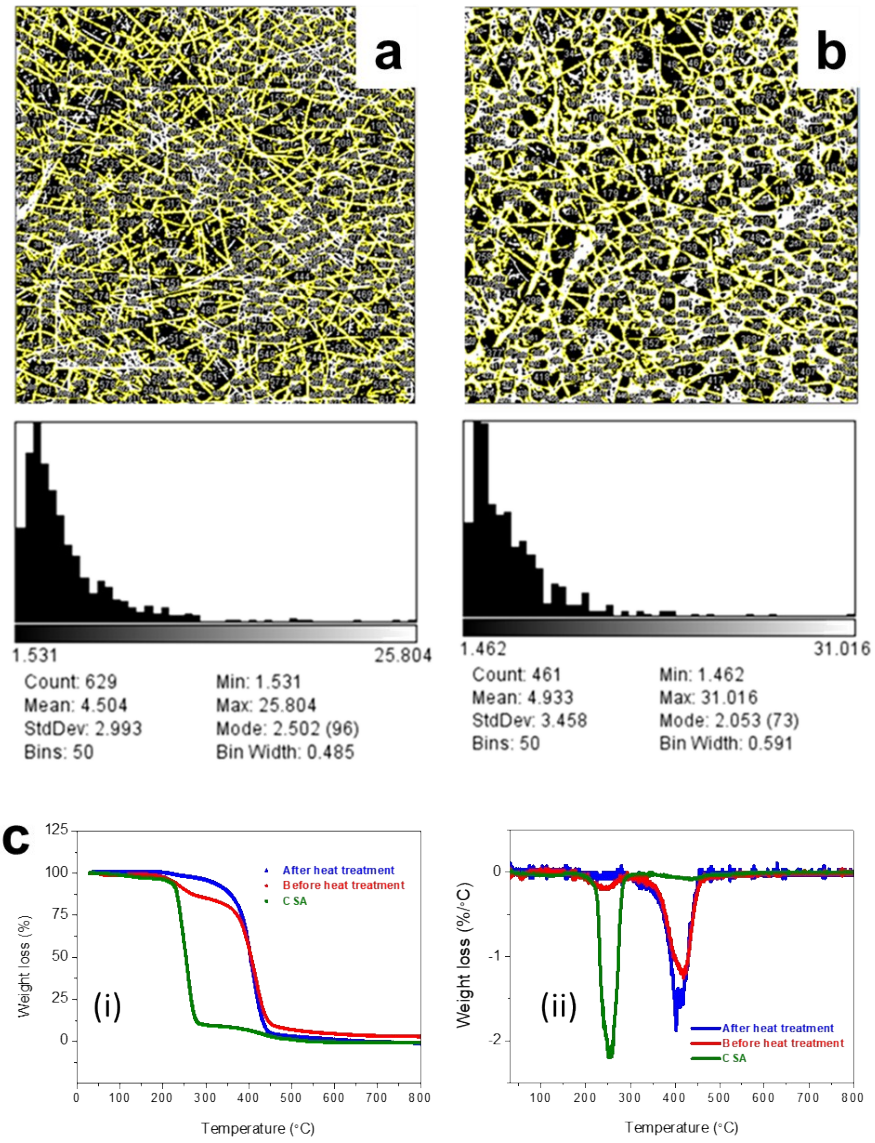


**Fig. S5** Determination of the fiber mat porosity and the pore size distribution for (a) untreated and (b) 140 °C treated nanofibers. The porosity of fiber mats was determined from the 2D-microscopic pictures by ImageJ. All black areas with a size larger than 1 µm were hereby counted and the pore size distribution as well as the number of counts was determined. (c) Thermogravimetric (TG) (i) and differential thermogravimetric (DTG) (ii) curves of post-doped PANI nanofibers before and after heat treatment at 140°C for 1 h as well as free CSA.

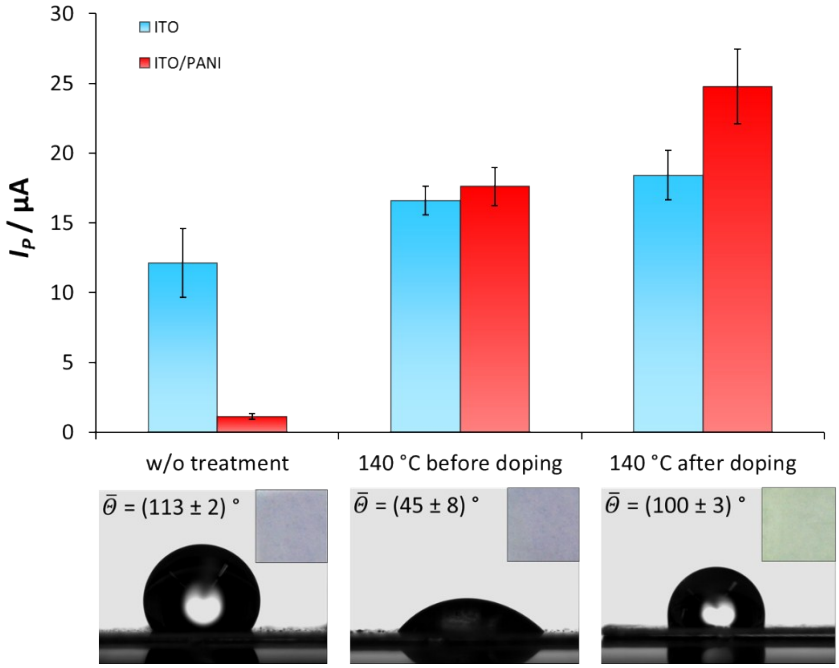


**Fig. S6** Effect of thermal treatment sequence on current response of bare ITO and nanofiber-modified ITO electrodes, and on the wetting property and color change of treated fiber mat; in which the left, middle and right picture indicate the water contact angle of w/o any treatment, heat treatment before acid doping, and heat treatment after doping, respectively. CVs were recorded in 1 mM potassium ferri/ferro hexacyanide solution (in 0.1 M phosphate buffer, pH 7.0, 0.1 M KCl) from -600 mV to +1200 mV and a 50 mV $s^{-1}$ scan rate.