Polyaniline/Poly (2-acrylamido-2-methyl-1-propanesulfonic acid) modified cellulose as promising material for sensors design

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Supporting Information

S1 Characterization

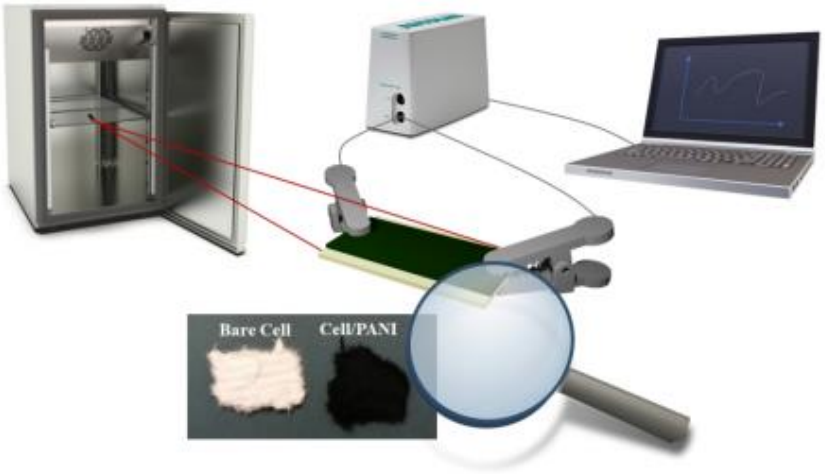

Fig. S1. Set-up for the climatic chamber.

Fig. S2. One of the co-authors (VDM) showing the device set-up and electronic connection for respiratory behaviour.

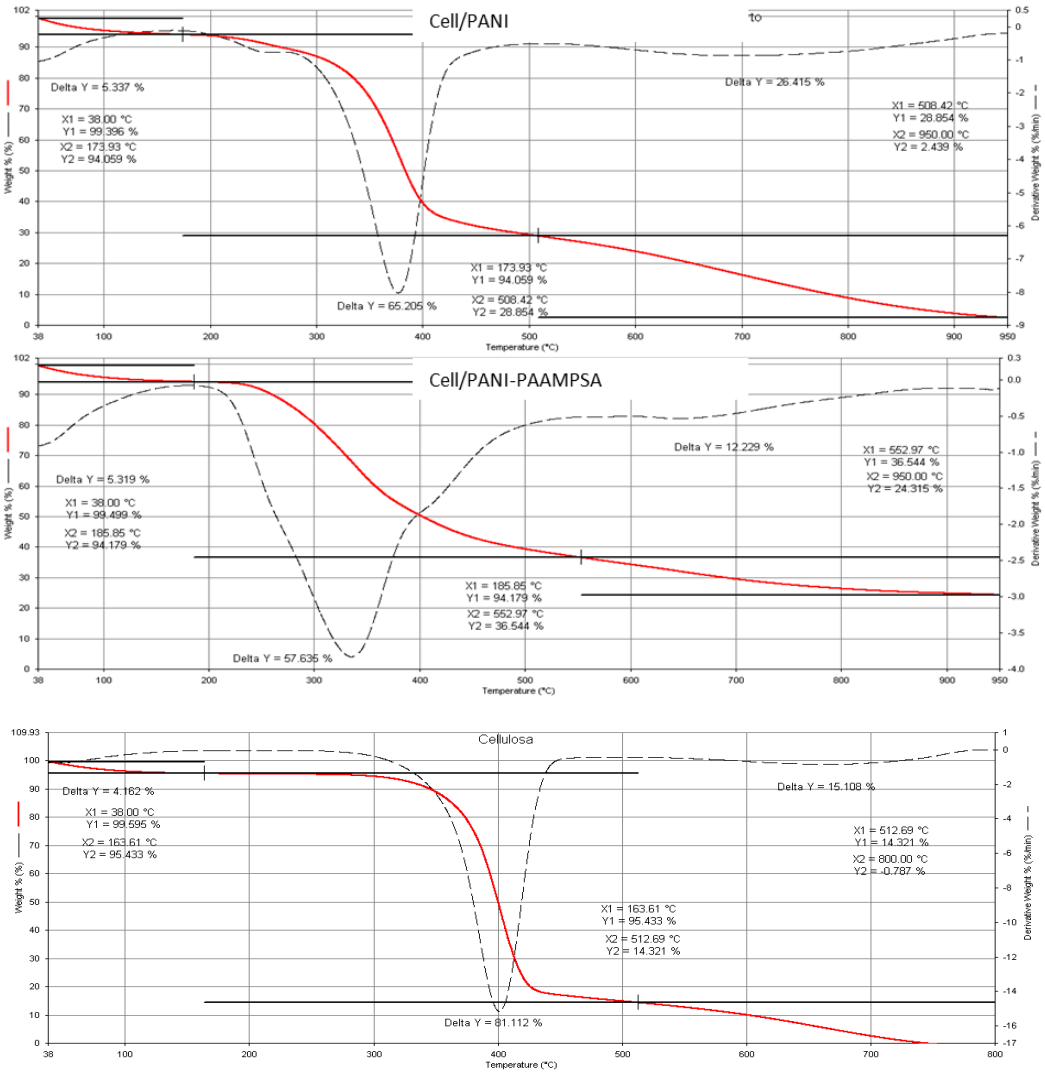

Fig. S3. TGA of Cell/PANI and Cell/PANI-PAMPSA and bare cellulose.

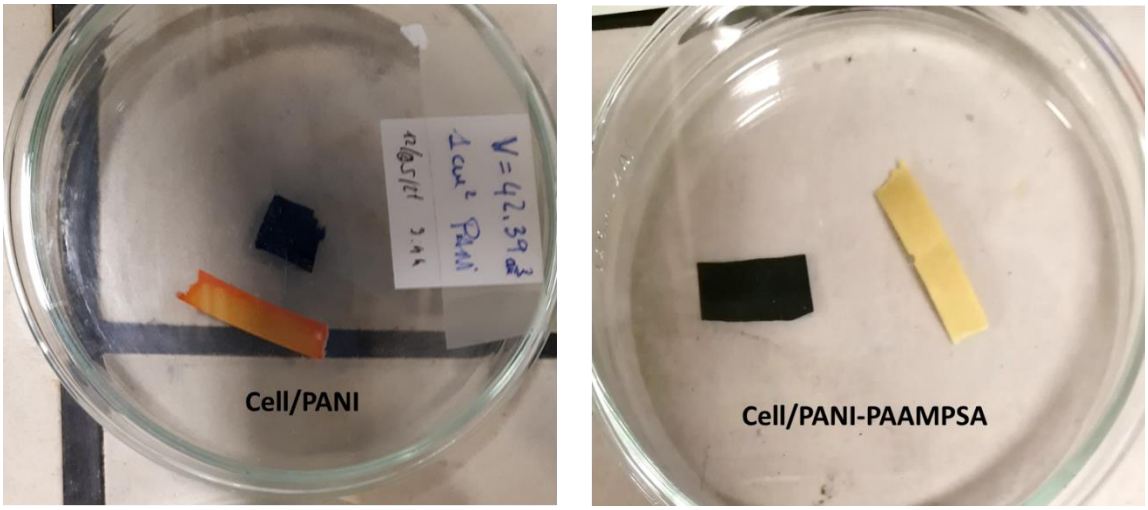

Fig. S4 Environmental stability: Left: Cell/PANI; right: Cell/PANI-PAAMPSA after 48 h.

Electrical and mechanical measurements

Resistance measurements were made with a Keysight B2902A source meter units in a 4-line-probe configuration. The sample was prepared with a rectangular shape and was held down with an insulating material by exerting a uniform pressure on the whole surface. The inner electrodes measure the difference of potential while a constant current flow is forced between the two outer electrodes (Fig. S5).

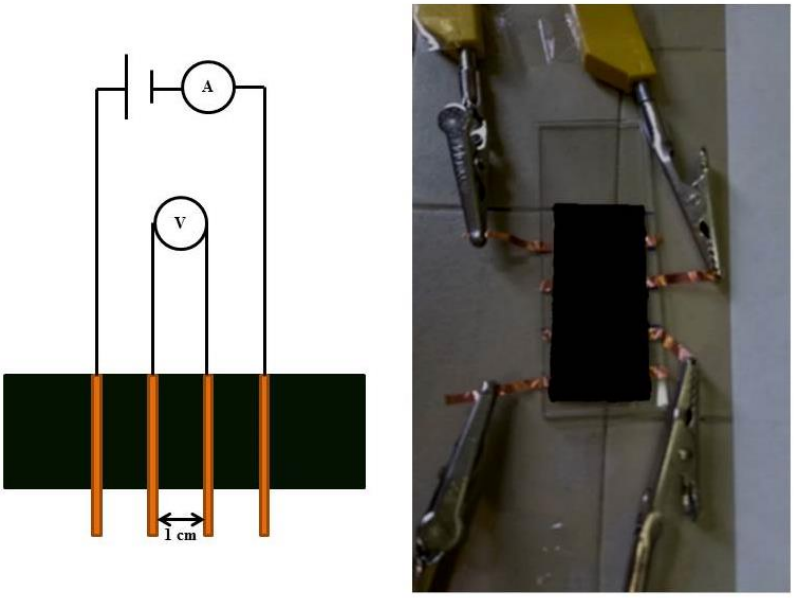

Fig. S5. Sample holder for resistance measurements.

The measurements were performed at different current values (100, 200, 300 μA) and a line passing from the origin was always obtained. The resistance (R) was calculated with the Ohm's law and the sheet resistance ($R_{\blacksquare}$) is equal to:

$$R_{\blacksquare} = R\,\frac{W}{L}$$

Where W and L are the width and the length, respectively.

The specific resistance (ρ) can be calculated by:

$$\rho = R_{\blacksquare}\,t$$

Where *t* is the thickness. The specific conductance (κ) is calculated by:

$$\kappa = \frac{1}{\rho}$$

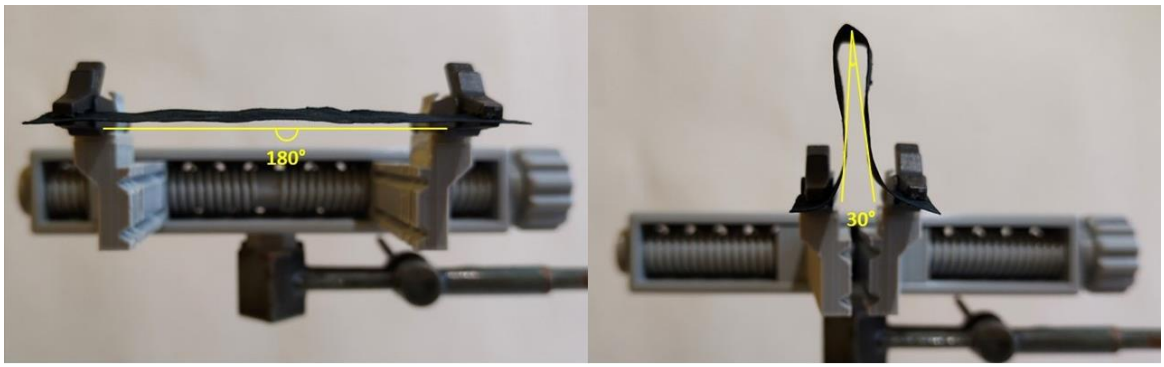

Fig. S6. Homemade 3D printed support and bending angles for mechanical tests. Bending angle 30°.

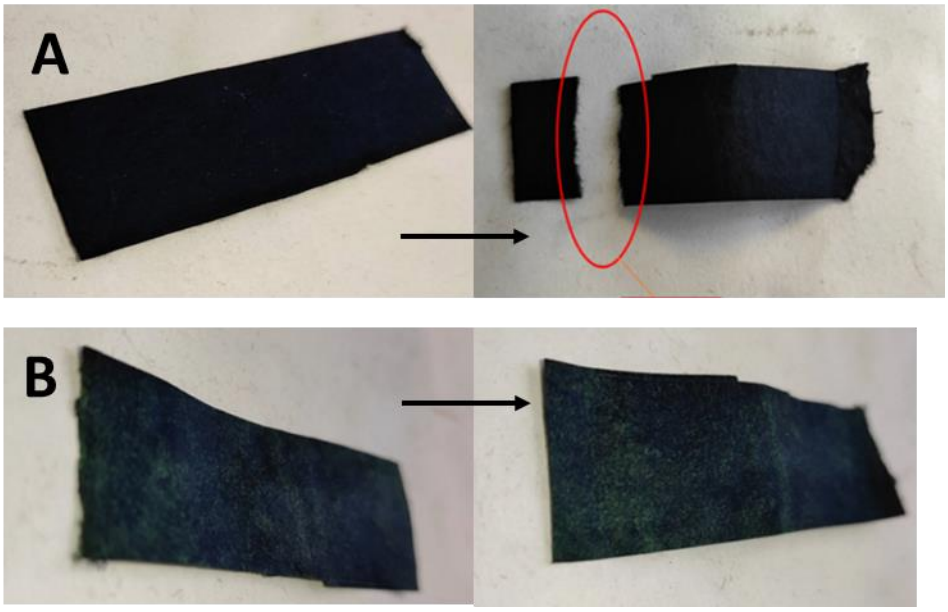

Fig. S7. Cell/PANI (A) and Cell/PANI-PAMPSA (B) before and after 200 foldings.

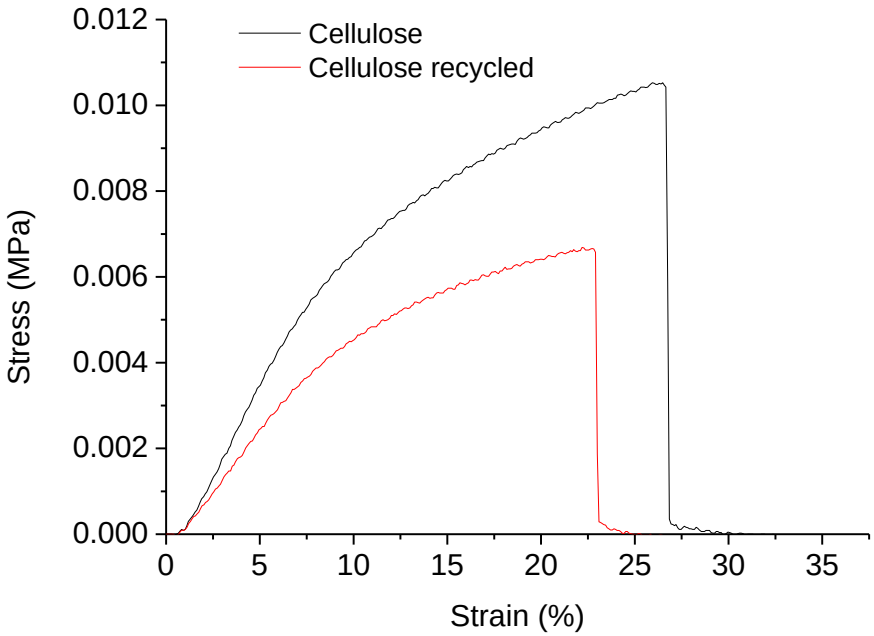

Fig. S8. Stress-strain curves obtained for pristine (black), and recycled Cellulose (red).

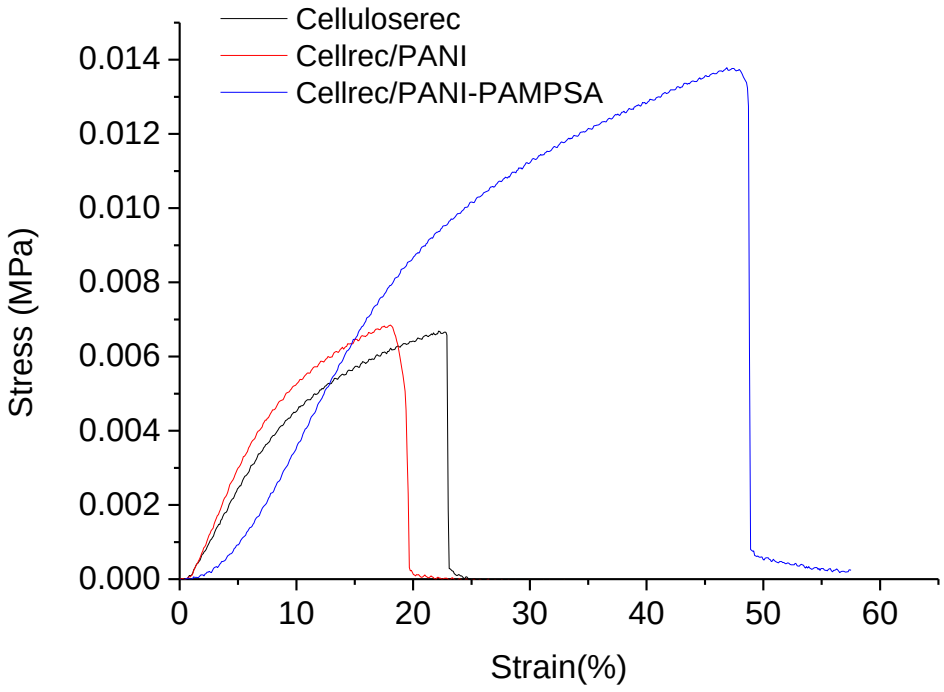

Fig. S9. Stress-strain curves obtained for recycled Cellulose (black), Cellrec/PANI (red) and Cellrec/PANI-PAMPSA (blue).

Table S1. Tensile strength values obtained from mechanical tests for recycled Cellulose, Cellrec/PANI and Cellrec/PANI-PAMPSA.

Sample	Stress at break (MPa)	Strain at Break (%)
Cellrec	0.0062±0.0005	21±1
Cellrec/PANI	0.0063±0.0005	17±2
Cellrec/PANI-PAMPSA	0.0137±0.0004	47±5

S2 Device Applications

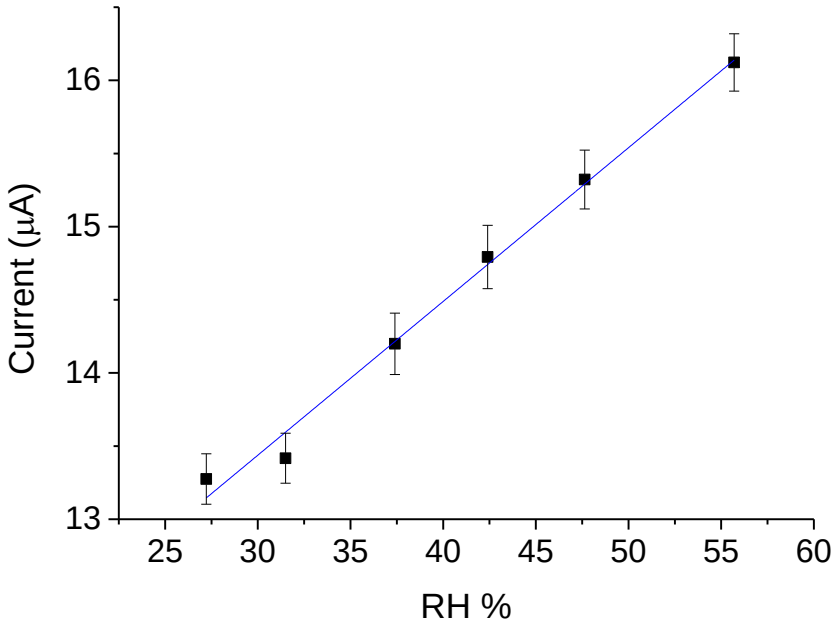

Fig. S10. Current versus % RH response curves characteristic for Cell/PANI PAMPSA. Equation: y =0.11x + 10.28 (R^2= 0.996).