Supporting Information

Ultrasoft Porous 3D Conductive Dry Electrodes for Electrophysiological Sensing and Myoelectric Control

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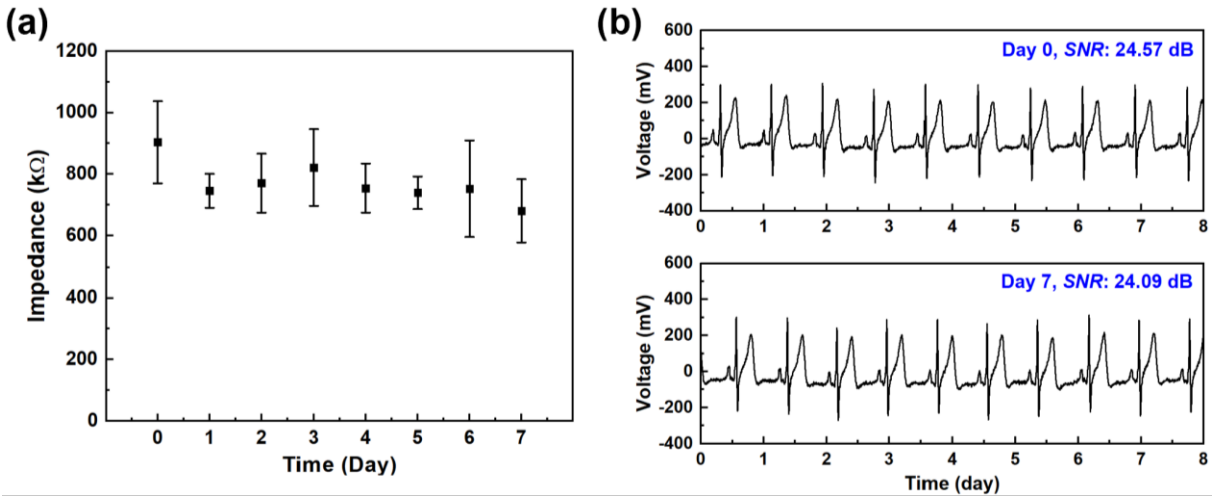


Figure S1. Evaluation of the developed porous dry AgNW/Ecoflex electrodes during 7-day continuous wear with light physical activities. (a) Changes in the electrode-skin impedance at 1 Hz for 7 days (measured at 8 pm every day). (b) Comparison of ECG signals collected from the electrodes on day 0 and day 7 at 8 pm.

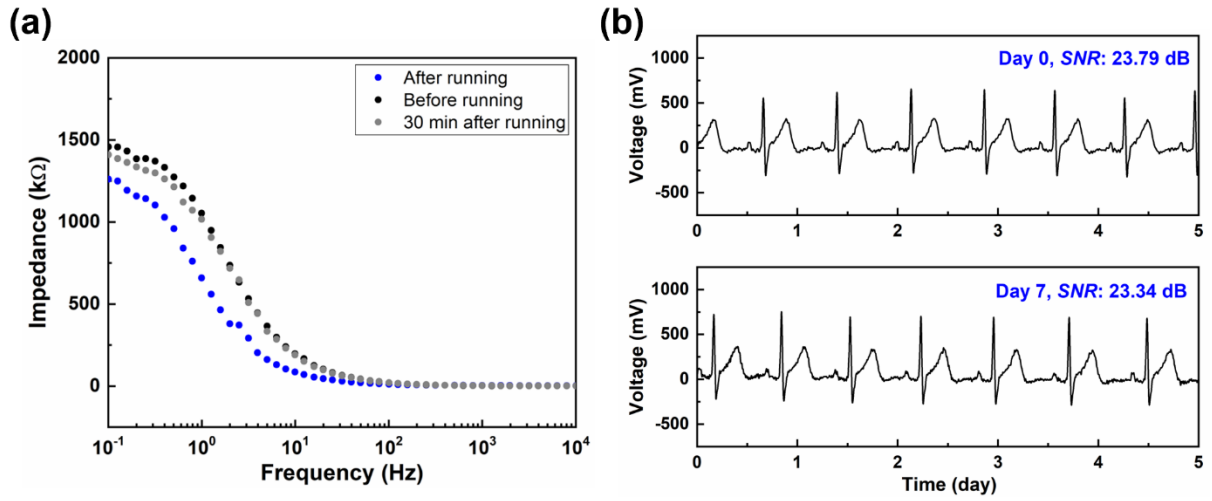


Figure S2. Evaluation of the developed porous dry AgNW/Ecoflex electrodes during 7-day continuous wear with intensive physical activities. The subject was aksed to run on the treadmill with an average speed of around 7 mph every day at 3 pm. (a) Changes in the electrode-skin impedance at 1 Hz before and after running. (b) Comparison of ECG signals collected from the electrodes on day 0 and day 7 at 8 pm.

For experiments conducted in Figures S1 and S2, four electrodes were continuously worn on the skin surface and only temporarily taken off during bathing or showering. Two electrodes were placed 3 cm apart on the left forearm for electrode-skin impedance measurements. For ECG sensing, one of these electrodes from the left forearm and another electrode placed on the right forearm were used as the recording and reference electrodes. One electrode placed on the right ankle was used as the ground electrode. Details about electrode-skin impedance measurements and ECG signal collection and processing can be found in the "Methods" section.

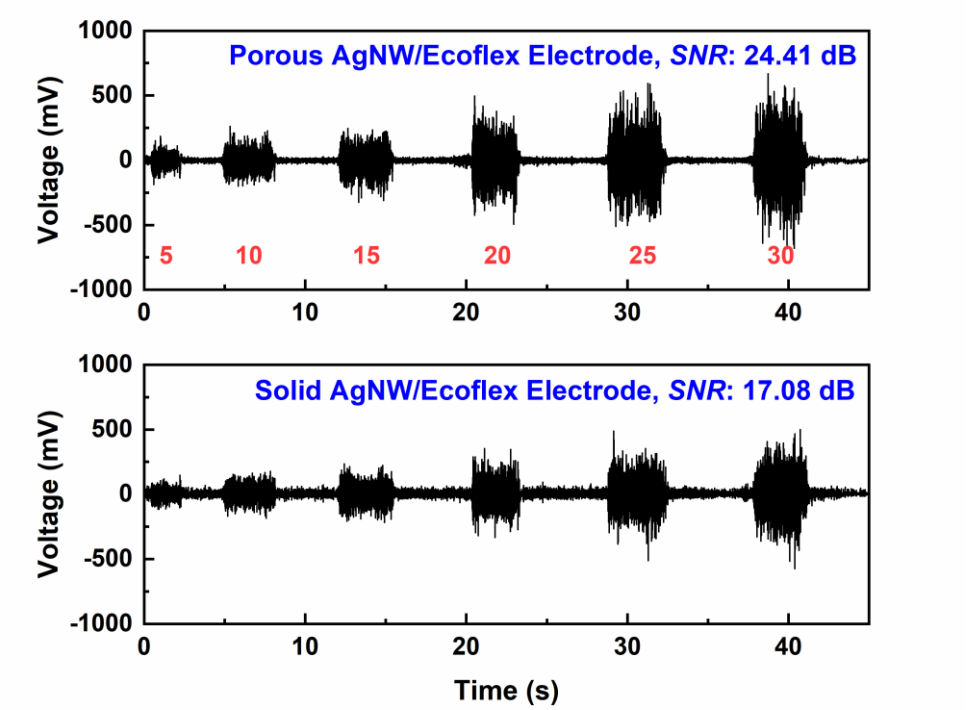
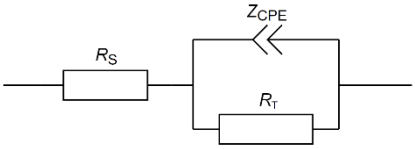


Figure S3. Comparison of EMG signals collected with the developed ultrasoft porous AgNW/Ecoflex electrodes and much stiffer solid AgNW/Ecoflex electrodes without the porous structure. During the experiments, the subject was asked to squeeze a hand dynamometer with different grip strengths from 5 to 30 N as measured by the hand dynamometer.

Table S1. Fitting data of the measured electrode-skin impedance (Figure 3d) for solid AgNW/Ecoflex and porous AgNW/Ecoflex electrodes. The equivalent circuit model is shown below.



Parameters	Porous AgNW/Ecoflex Electrodes	Solid AgNW/Ecoflex Electrodes
R_S (Ω)	132.1	372.4
R_T (MΩ)	1.72	4.30
CPE-Q (μF s^{n-1})	0.79	0.56
CPE-n	0.80	0.74

Table S2. Comparisons of 10 porous AgNW/Ecoflex electrodes fabricated in 5 batches. Granulated sugars were used as the sacrificial template and 8 dip-coating cycles were performed to achieve the conductivity listed below. Details about electrode-skin impedance measurements and ECG signal collection/processing can be found in "Methods".

Sample Number	Conductivity (S/cm)	Modulus (kPa)	Electrode-Skin Impedance (at 1 Hz, kΩ)	SNR (dB)
1	315	11.8	964.4	24.45
2	65.5	3.7	898.0	25.89
3	15.7	9.6	955.8	24.93
4	85.4	23.2	1001.1	22.97
5	105.5	10.1	973.5	24.65
6	37.3	5.8	942.5	24.97
7	77.9	17.7	978.8	23.99
8	65.8	8.9	957.0	25.29
9	45.1	10.3	967.4	24.57
10	174.1	36.1	1053.7	21.38