Supplementary Information (SI) for Journal of Materials Chemistry C. This journal is © The Royal Society of Chemistry 2024

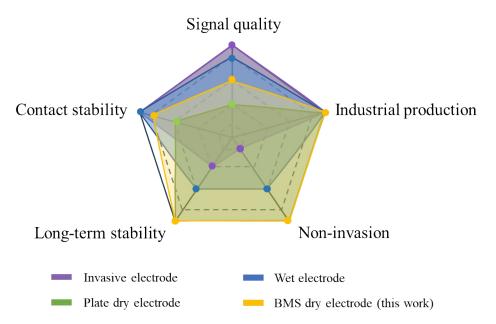


Figure S1 An radar chart of general comparison of 1) signal quality, 2) contact stability, 3) long-term stability, 4) non-invasion, and 5) industrial production between invasive electrode, wet electrode, plate dry electrode and BMS dry electrode (this work).

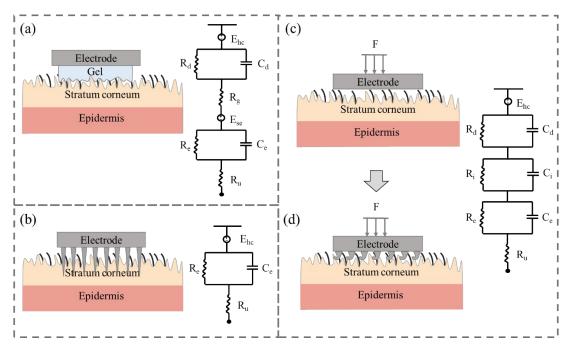


Figure S2 Schematic and electrical equivalent circuit model of electrode-skin interface for a) wet electrode, b) invasive electrode, c) plate dry electrodes and d) BMS electrodes (this work). Compared with surface dry electrodes, the barb structure is able to pass through hairs and lead a closer but non-invasive contact with skin.

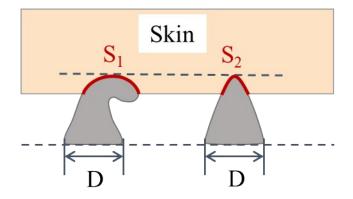


Figure S3 Schematic diagram of barb structure and dome-shaped structure. Compared with the micro dome-shaped electrodes, the unique barb structure of BMS electrodes can maintain a larger contact area with the skin. The pressure of BMS electrodes on the skin is less under the same external pressure, which has a significant comfort of use.

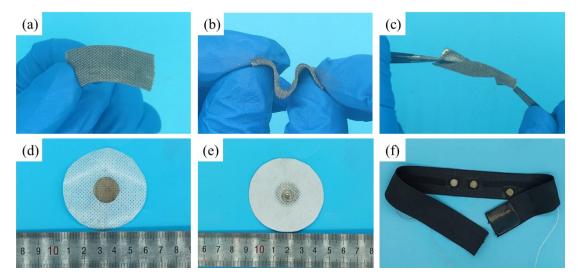


Figure S4 Optical photograph of (a) original TPU BMS film, TPU BMS film under (b) bending and (c) twisting, and optical photograph of EEG electrode patch (d) front view and (e) back view, and EEG testing headband.

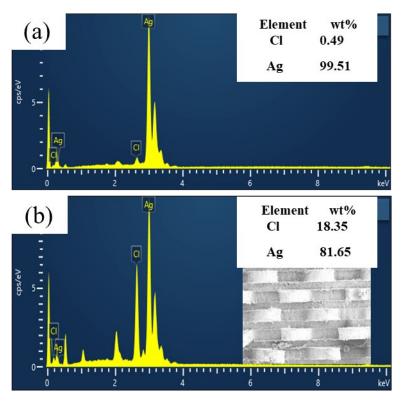


Figure S5 Characteristic X-ray energy spectra (a) before chlorination and (b) after chlorination

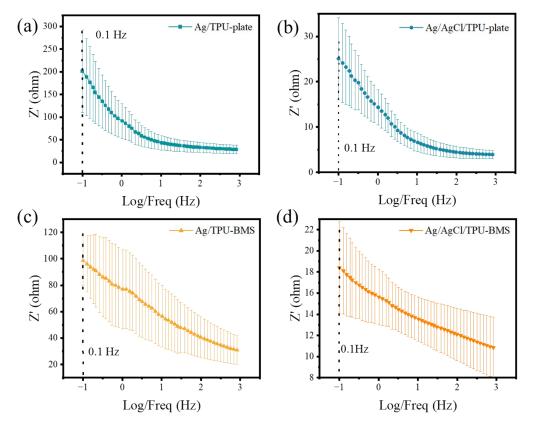


Figure S6 Electrode electrolyte interface: impedance-frequency curve (a) Ag/TPU-plate, (b) Ag/AgCl/TPU-plate, (c) Ag/TPU-BMS, (d) Ag/AgCl/TPU-BMS

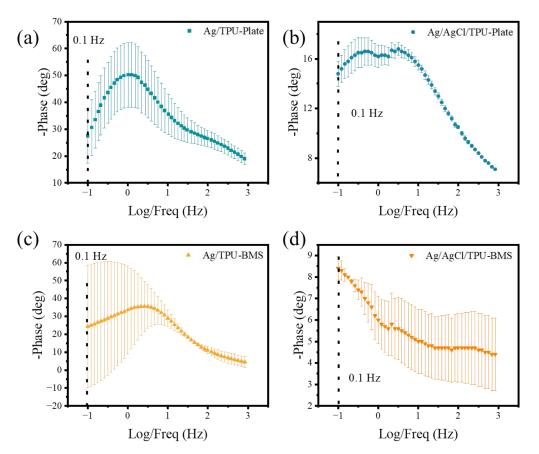


Figure S7 Electrode electrolyte interface: phase degree-frequency curve (a) Ag/TPU-plate, (b) Ag/AgCl/TPU-plate, (c) Ag/TPU-BMS, (d) Ag/AgCl/TPU-BMS

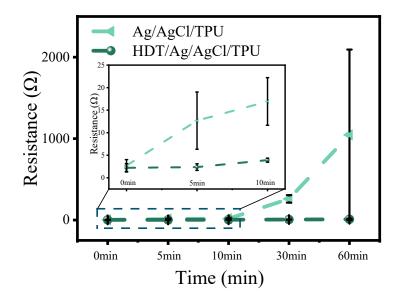


Figure S 8 Changes in resistance after Na<sub>2</sub>S corrosion for 0-60min

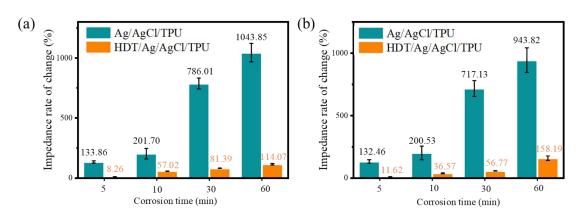


Figure S 9 Impedance rate of change of the electrodes before and after mercaptan treatment in Na<sub>2</sub>S solution of (a) 0.1Hz, and (b) 10Hz

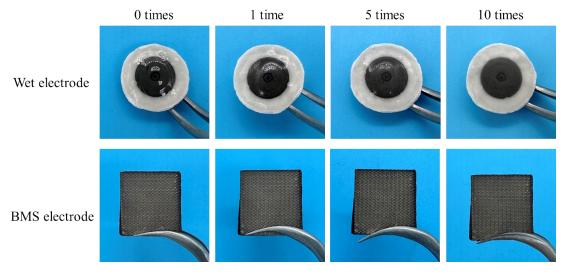


Figure S 10 Optical photographs of wet electrode and BMS electrode be adhered on human skin after 0 times, 1 time, 5 times and 10 times

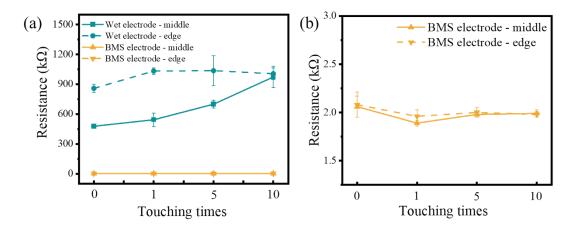


Figure S 11 Resistance of wet electrode and BMS electrode be adhered on human skin after 0 times, 1 time, 5 times and 10 times

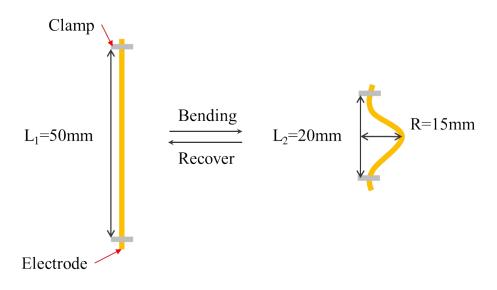


Figure S 12 Schematic diagram of bending test

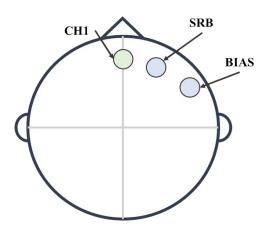


Figure S 13 Schematic diagram of electrodes position for on-body EEG testing

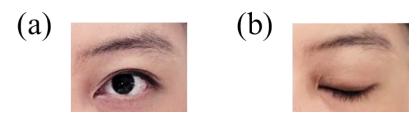


Figure S 14 Photographs of eyes condition for on-body EEG testing (a) calm opening and (b) calm close. Blinking occurs when (a) and (b) repeats.

	Table S T sample information
Samples	Explanation
TPU	The barb microstructure TPU membrane before silver plating
Ag/TPU	The barb microstructure TPU membrane after silver plating
Ag/TPU-plate	A plate TPU membrane with silver plating
Ag/TPU-BMS	A barb microstructure TPU membrane with silver plating
Ag/AgCl/TPU	A silvered TPU membrane after chlorination
HDT/Ag/AgCl/TPU	The final electrode, which has a barb microsture TPU

Table S 1 sample information

Ag/AgCl/TPU-plate (Plate) Ag/AgCl/TPU-BMS (BMS) Wet membrane, a Ag/AgCl plating, and after mercaptan treatment A plate TPU membrane with Ag/AgCl plating A barb microstructure TPU membrane with Ag/AgCl plating The wet electrode