Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Supplementary Note 1: Properties of the printed e-skin

The printed materials maintained excellent adhesion to the different surfaces with no delamination even after repeated bending/stress cycles. The printed e-skin is ultrathin (≈100 µm), and lightweight (0.018 g) and may enable cost-effective triboelectric devices. In addition, when the human skin was wrinkled, the devices precisely followed the irregular surface and fine ridges of the skin, which confirm excellent conformability of the devices. The films vary in color from semi-transparent to white depending on the coating thickness. **Figure S1** shows the surface topology of the printed film using optical microscopy. The images show interconnected particles that adhere to each other and the substrate forming porous, yet continuous films. This microstructure renders our devices mechanically flexible without compromising the integrity of the films, which is necessary for stable triboelectric performance and durable on-skin electronics. Furthermore, Fourier-transform infrared spectroscopy (FTIR) of the raw camphor powder and its printed counterpart show almost identical peaks with no indication of a wavenumber shift, confirming the stability and absence of a chemical change of the tribo-material before and after printing, **Figure S2**. These exceptional physical and mechanical properties hold great promise for on-skin and wearables applications.

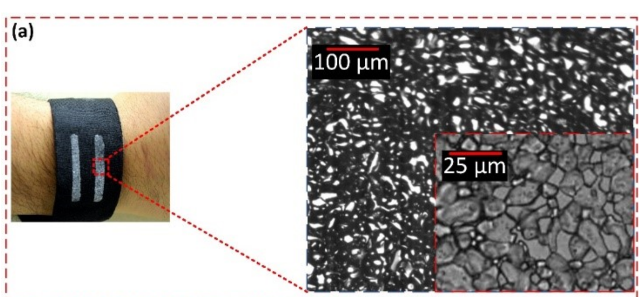

Figure S1. An optical image and Optical microscopic images at different magnification of the on-textile printed sublimatable film.

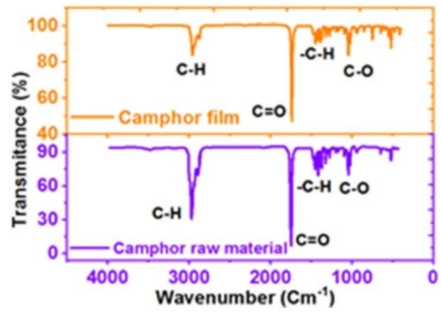

Figure S2. FTIR spectra of fresh camphor raw material ballets before and after the printing process.

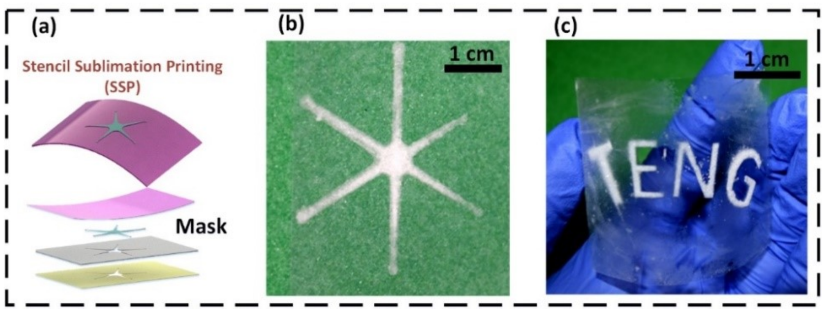

Figure S3. Feasibility of the printed S-TENG using SSP technique. (a) The cartoon shows the stencil sublimation printed mask screen, **(b)** The real photo of printed star-shape on a sheet of paper, **(c)** Photograph of the TENG word printed on a curved surface with a radius of curvature of ≈ 3.5 cm.

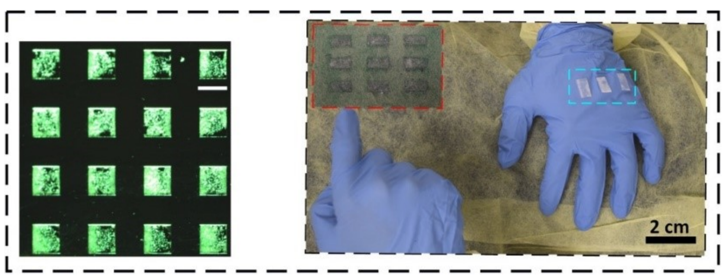

Figure S4. Scalability of the printed S-TENG using SSP technique. (a) Optical images of a printed micro-patterned array (4x4 pixels), of scale bar, 50 μm, Optical images of (3x3 pixels) array printed on a textile (gown) as well as disposable gloves.

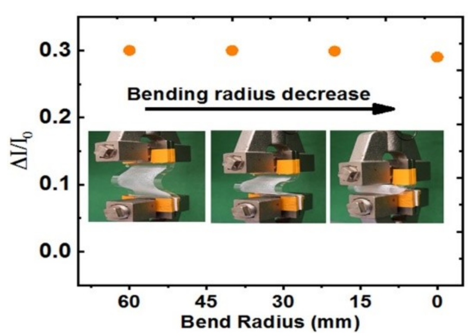

Figure S5. Variations in normalized triboelectrification current of the S-TENG during bending at different angle (bending radius from 0-60 mm). The inset shows the experimental setup

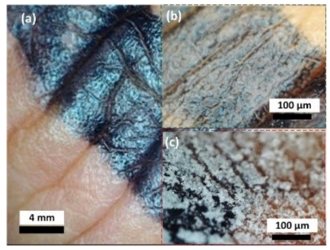

Figure S6. Conformability, breathability of the printed S-TENG. **(a-c)** Optical images showing the high conformability and breathability of the printed S-TENG on the irregular tribology of the human skin.

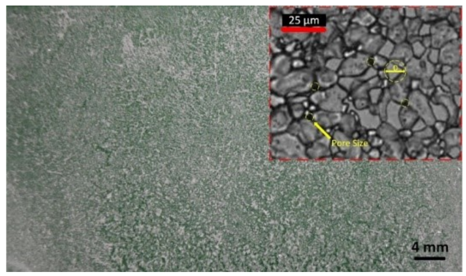

Figure S7. Breathability of the printed S-TENG. The porous structure of the printed camphor film, Top view of the camphor film showing the pores resulting from the assembly of sublimatable molecules. The pore diameter (d) and particle size (D).

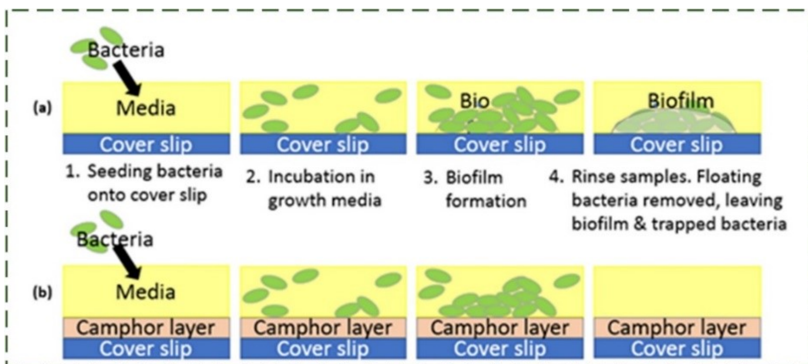

Figure S8. Scheme illustrates step-by-step the comparison between the Biofouling test at two cases **(a)** control cover slip **(b)** cover slip coated with a sublimed camphor layer. The first step was inoculating bacteria on top of the cover slips that were submerged in media. Then, the samples were incubating for certain time to examine the formation of the biofilm. Finally, the samples were rinsed to get rid of any floating debris. Only the biofilm and bacteria within would be left adhered to the surface.

Supplementary Note 2: Cultures of Escherichia coli K12 Green Fluorescent Protein (GFP)-tagged were grown overnight in tubes with 5 mL LB media at room temperature (**Figure S8a (1-4)**). After that, aliquots of 20 µL from the overnight culture were inoculated into 2 mL of LB media in 35 mm dishes, on top of cover slips of the different conditions. The incubation of the samples was done in plastic bags at 37^{o}c for 2 days. Then the samples were rinsed at least twice with 2 mL of saline solution (**Figure S8b (1-**

4)). Imaging of the dry GFP-labelled bacteria was enabled by Olympus Inverted Fluorescence microscope (Model IX51S1F-3). A biofilm assay was then used to evaluate the antibacterial activity of camphor.

Figure S9. Degradability of the printed S-TENG using SSP technique. The degradation process of a star-shaped pattern, which shows the slow disappearance of the pattern over time and under ambient conditions of room temperature and 30% humidity.

Supplementary Note 3: This model is based on single electrode S-TENG and ground electrode with a dimension of 2.5 cm in length and 2.5 cm in width and a thickness of 2 mm while the triggering layer is 1 mm thick. The S-TENG electrode is connected to ground and is given to a uniform 50 $\mu C \cdot cm^2$ triboelectric charge density. At the contact area, the electrical potential approaches zero (**Figure 4c**). When two materials are detached, the electrical potential difference rises dramatically, reaching a maximum of 6 V at a distance of 10 mm. The simulation results agree with the working principle described in here.