Supplementary Information

The influence of the morphological characteristics of nanoporous Anodic Aluminium Oxide (AAO) structures on capacitive touch sensor performance: a biological application

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Fabrication technology: production of AAO nanoporous structures by Al anodization

The anodizing process was realized in a homemade anodization cell comprising an anode (pre-treated Al foil) and a cathode (Pb plate). The body of the electrochemical cell is made of polypropylene material and has a cylindrical geometry fabricated by lathe machining a solid polycarbonate billet. The total volume of the anodization cell is about 220 ml, where the anode is placed at the bottom and holds a circular geometry with a diameter of 20 mm. The cathode consists of one Pb plate with rectangular-type geometry and dimensions of (105 ×15×4) mm. Some geometrical details related with the homemade anodization cell are properly identified in the Fig. SI1 (a) and (b).

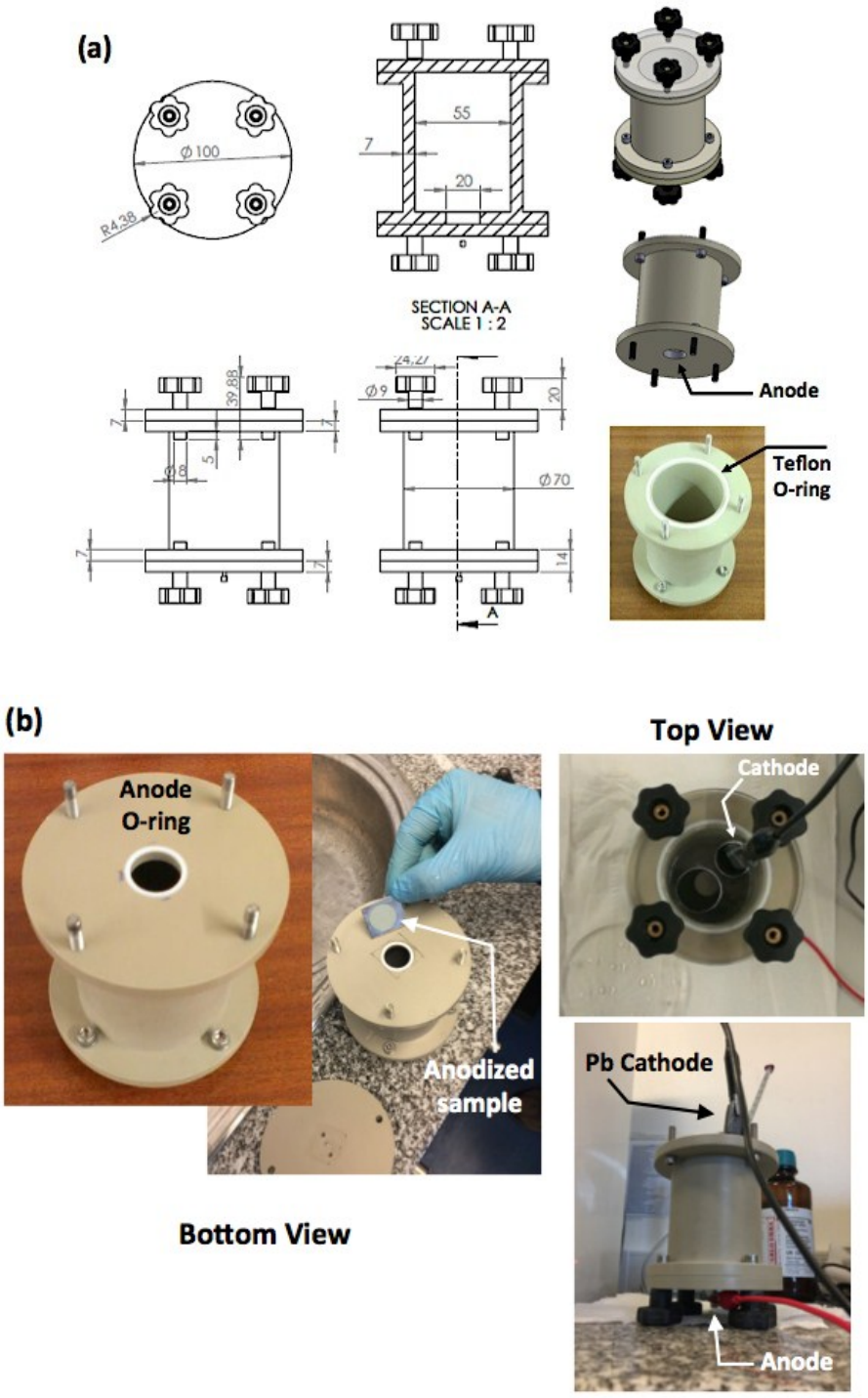

Fig. SI1 – The homemade anodization cell. (a) geometric dimensions and some 3D views and (b) photographs of the electrochemical cell where the circular anode is placed at the bottom of the cylinder and cathode is a rectangular Pb plate.

Deposition of a nano-textured Au top electrode

Fig. SI2 (a) is a photographic image on a part of the resistive thermal evaporation system (tungsten boat containing a wire of gold) used to accomplish the deposition of a thin film of Au on the AAO surface the surface aiming the production of a nano-textured gold circular top electrode. The thermal evaporating system includes a deposition chamber with a volume of 3.8 L, a primary rotary pump (with a pumping speed of 5000 L/h) and a diffusion pump with a pumping speed of 110 L/s. The fabricated nano-textured Au circular top electrode has a radius of 3.75 mm, which is connected to a gate with a length of 5 mm. To serve this purpose, a specific mask fabricated from an Al sheet, whose geometry is shown in Fig. SI2 (b) and (c).

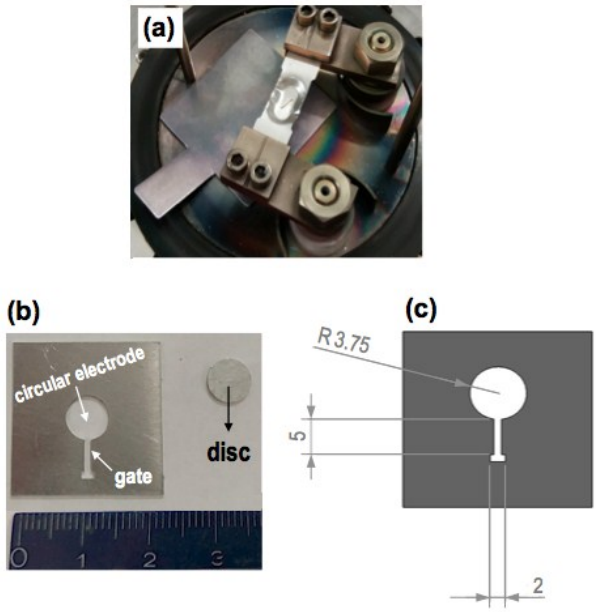

Fig. SI2 – Thermal evaporation of the Au top electrode. (a) Au wire placed in a tungsten boat; (b) geometry of the used mask to coat the anodic surfaces with the Au thin film and (c) technical specifications for mask construction (units in millimetres).

Each of the fabricated AAO samples was subjected to two consecutive Au thermal evaporation stages. In the first stage, the mask pattern was totally transferred to the surface of the nanoporous AAO structure. The second Au evaporation stage was only performed over the gate by covering the circular region of the mask by a metal disk with a 3.75 mm radius, as schematized in Fig. SI3 (a). The purpose of this procedure

was to obtain an Au top electrode with a nano-textured surface and circular geometry, which in turn is directly linked to a compact gate.

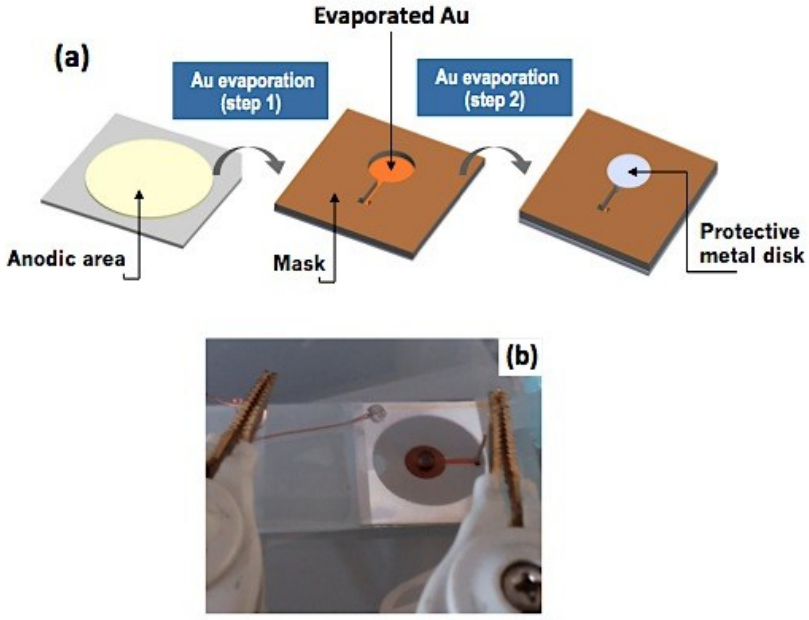

Fig. SI3 – Evaporation steps of the Au film in order to perform the transfer of the mask pattern to the surface of nanoporous AAO structure to form the Au top electrode (a) and (b) final assembly of the AAO-based capacitive sensor showing the all the electrical connections to a LCR meter.

Fig. SI3 (b) is a photographic image of final assembly of the AAO-based capacitive sensor showing all the electrical connections to a LCR meter. In particular, note that placing a small needle on the surface of the linked compact gate pad performed the electrical connection of the nano-textured Au top electrode. The Al substrate, which supports the AAO structure, acts as the bottom electrode to which, a copper wire was subsequently attached using silver paint.

Preparation of a bacteria culture as agents for touch sensing tests

The experimental sequence of the performed biological tests is schematically depicted in Fig. SI4.

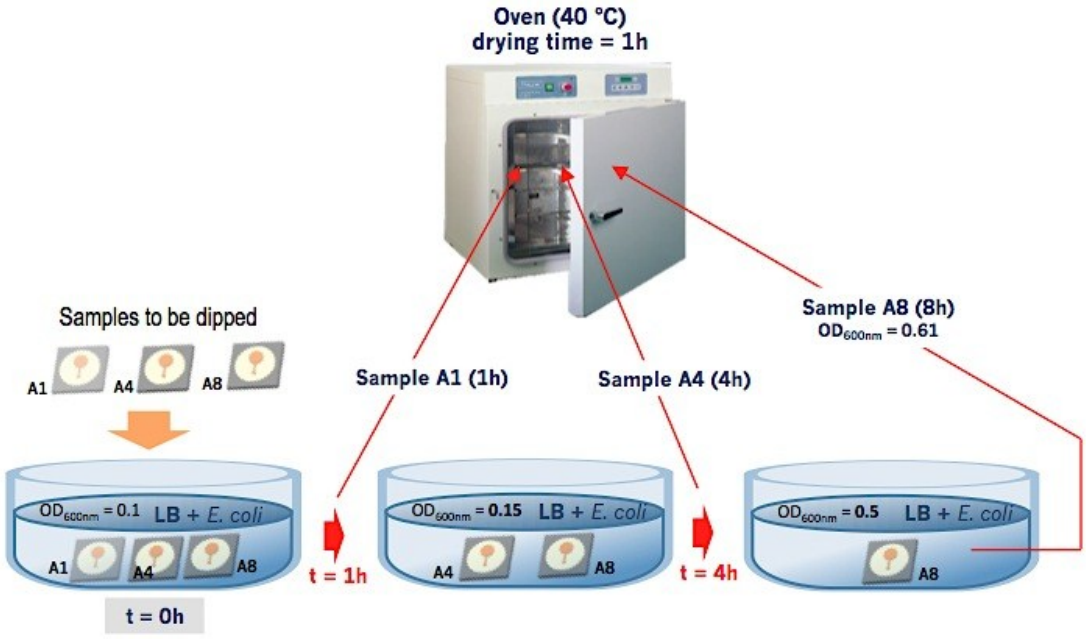

Fig. SI4 – Sequence of the biological experiment to test the performance of the AAO-based capacitive touch sensors using *Escherichia coli* as model.