Dielectric Elastomer Sensors For the Tongue-Computer Interface

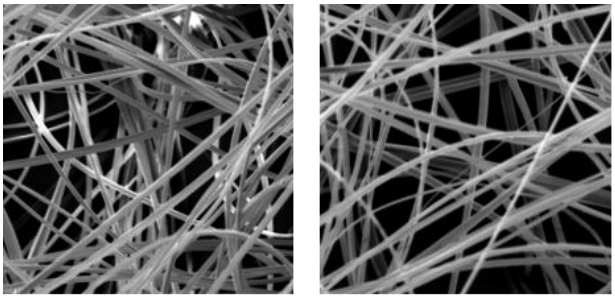

Figure 1: Electrospun fiber network visualized by electron microscopy (Picture: L. Luchsinger).

Figure 2: Two dielectric elastomer sensors embedded between two moulded substrates for their integration/implementation into a personalized dental splint. (Picture: R. Wendler/DBE)

Master Thesis in Biomedical Engineering by Carina Luchsinger Salinas at the Biomaterials Science Center.

This thesis project pursued the development and comprehensive characterization of a sensor prototype for the tongue-computer interface. These dielectric elastomer sensors are micrometer-thin and highly flexible and thus well suited for intraoral tongue-machine interface applied for the treatment of sleep apnea and snoring problems through digitalized myofunctional therapy.

The elastically deformable pressure sensors consist of elastomer films sandwiched between compliant electrodes [1]. The application of a force changes the capacitance of the device. Such sensors are attractive for a variety of applications in wearable electronic devices, soft robotics and touch-sensitive electronic products [2]. In order to guarantee softness and flexibility, the sensor prototype contains a nonwoven porous network of polymer fibers. The micro- and nanometer-thin fibers were fabricated employing an electrospinning technique [3].

The pressure sensors can operate in the range between 1 kPa and more than 10 MPa. Its sensitivity at the characteristic tongue pressure of 100 kPa reached about 0.15 pF/kPa. Therefore, the prototype was functioning in the oral cavity to detect the tongue forces at predefined locations. Partners at Empa provided the electronics and the Zurich University of the Arts contributed to the software for the demonstrator device.

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Supervision:
Dr. Tino Töpper
tino.toepper@unibas.ch

Dr. Bekim Osmani
bekim.osmani@unibas.ch

Prof. Dr. Bert Müller
Biomaterials Science Center
bert.mueller@unibas.ch

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