Conducting Polymer Microelectrodes Printed on Hydrogel for Electrical Stimulation of Contractile Muscle Tissues

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Conducting polymers such as poly (3,4-ethylenedioxythiophene) (PEDOT) and polypyrrole (PPy) are attractive electrode materials due to their advantages of biocompatibility, high capacitance and flexibility. They have been utilized in biomedical devices, including implanted electronics and in-vitro devices for culturing cells. We present herein the micropatterning of PEDOT on hydrogel, to provide a fully-organic, moist, and flexible electrode [1]. The PEDOT/hydrogel electrodes are prepared through two electrochemical processes: the electropolymerization of PEDOT into the hydrogel and the electrochemical actuation-assisted peeling (Fig.1). The method is versatile for micropatterning PEDOT even on other or curvilinear hydrogels (Fig.2).

We demonstrated that the PEDOT/agarose electrode could be used for electrical stimulation of the contractile fibers that make up muscle tissue (myotubes). A film of contractile myotubes within a fibrin matrix was laid on top of the electrode and stimulated with periodic voltage pulses. The electrode induced contraction of the myotubes, and the electrode itself was observed to contract in unison with the myotubes.

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