WEARPLEX Gamma Workshop: Screen printed OECTs and OECT-based logic circuits

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Introduction

» Organic electrochemical transistors (OECT)
» Low-voltage operation (~1 V)
» High current throughput
» Scalable manufacturing, e.g., screen printing
» Flexible substrates (plastic, paper, textile)
» Promising in many application areas:
  » Logic circuits for addressing
  » Recording (EMG)
  » Functional Electrical Stimulation (FES)
  » Sensors, e.g., in stretchable electronics
Screen printed OECT-based logic circuits

» Simple logic circuits for addressability
» Possible to integrate into complex circuitry
» Monolithic integration with peripheral devices
» Compatible with large loads, e.g., displays
» Decoders and shift registers

Nature Communications 10, 5053 (2019)
Screen printed OECT-based logic circuits

» Reproducible switching performance
» High manufacturing yield
» 758/760 OECTs in one sheet operational (99.7 %)
» Addressability and high current throughput
» Novel process: approaching 100 mA

Flexible and Printed Electronics, 5, 024001 (2020)
Advanced Materials Technologies, 2101665 (2022)
npj Flexible Electronics, 4, 15 (2020)
Applications within WEARPLEX

» The target is to develop printed OECT-based circuits that can be integrated into the multi-pad electrodes, to simplify addressing by minimizing the number of wires.

» The printed circuits should preferably work ‘in both directions’, i.e., in both recording and stimulation applications, to enable multi-purpose usage.

» Upper: 8-bit shift registers for stimulation (FES) applications

» Lower: 8-channel multiplexers for recording (EMG) applications