INKJET-PRINTED CONDUCTIVE POLYMER ELECTRODES FOR AC ELECTRO-OSMOSIS

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AC Electro-osmosis
Standalone integrated microfluidic systems require pumping elements. Electro-osmosis (EO) is an effective method of actuating liquids [1,2]. ACEO exploits much lower potentials and, by using alternating fields, overcomes the issues of electrolysis and gas generation [3].

Why using PEDOT electrodes?
Poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate) (PEDOT:PSS) can withstand DC voltages as high as 100 V without electrolysis [5]. ACEO works fine with micromachined arrays of PEDOT electrodes [6].

A qualitatively good impedance
Comparison of printed polymer with evaporated Pt
PEDOT:PSS has lower impedance, due to a printed electrode gap smaller than designed

Sheet resistance
PT lift-off on PET (120nm) 2.2 ± 0.33 kΩ/sq.
PEDOT:PSS on PET 1.88 ± 0.33 kΩ/sq.

Pt lift-off on PET (120nm)

500-200-300 µm electrode patterns measured with KCl0.01M

Conclusion
PEDOT:PSS impedance has a comparable shape to that of Pt electrodes and both correspond well to theoretical predictions [8]. Inkjet-printed electrodes can be used for ACEO.

Impedance OK, but need smaller sizes for effective velocity generation

CHALLENGE for the future → Improve definition (need structures <100µm)

Acknowledgements
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