

Supplementary Information

Fabrication of ITO microelectrodes and electrode arrays using low-cost CO₂ laser plotter

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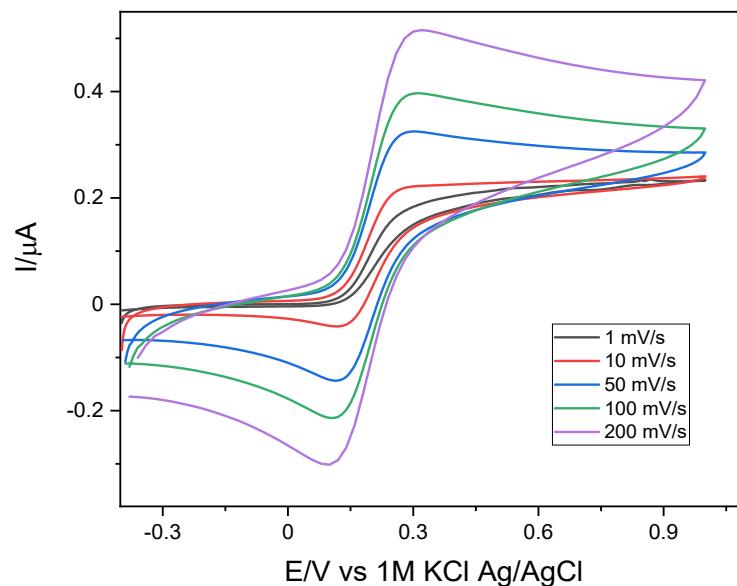


Figure SI 1. Performance of a 100 μm electrode at different scan rates; 1 mV/s, 10 mV/s, 50 mV/s, 100 mV/s and 200 mV/s.

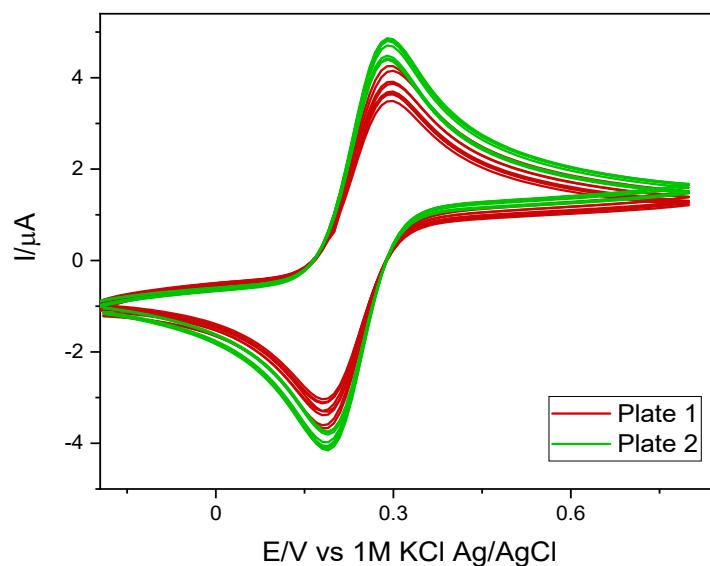


Figure SI 2. Cyclic Voltammogram of the ITO circular electrodes on different plates.

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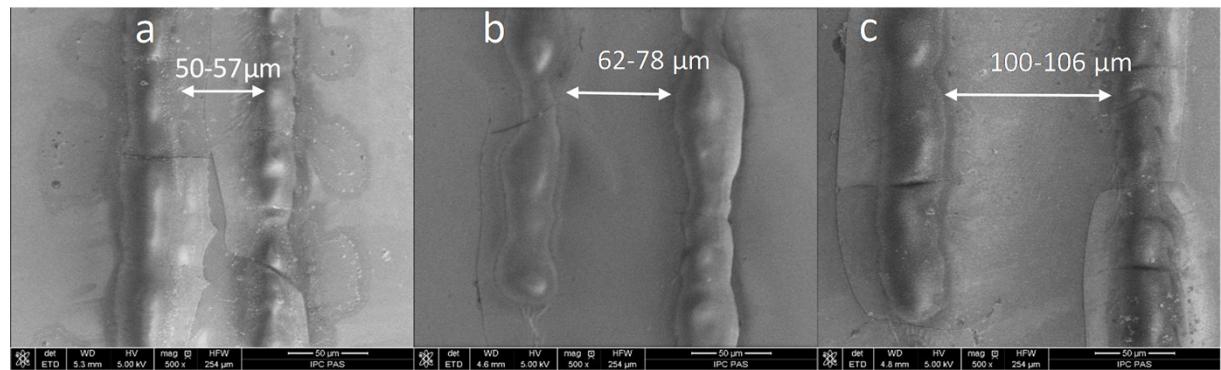


Figure SI 3. Scanning electron microscopy (SEM) images of the rectangular-shaped electrodes.
a) 25µm, b) 50µm, c) 100µm.

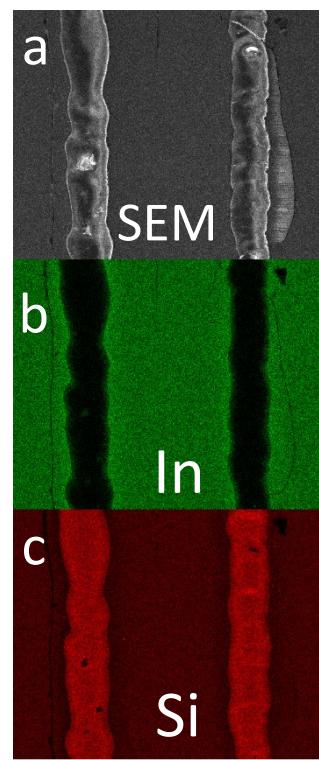


Figure SI 4. Detailed structural and morphological imaging of a 100µm electrode. a) an electron image (SEM image) of the electrode, b) an EDX map showing indium (green), c) an EDX map showing silicon (red).

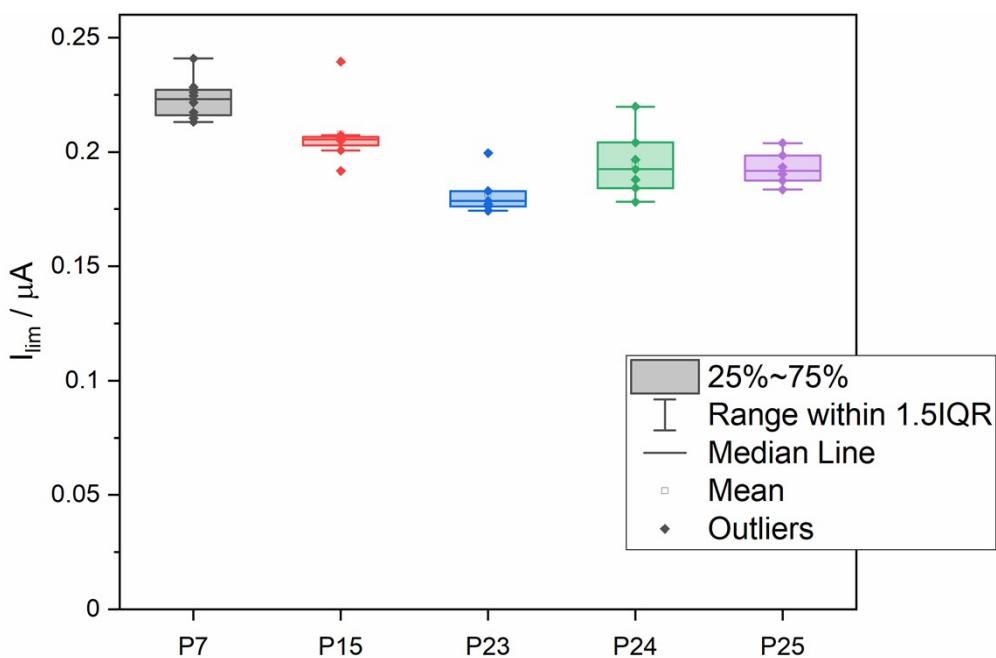


Figure SI 5. Comparison of current results obtained from cyclic voltammograms of 36 electrodes at 0.29V. The numbers at the x-axis represent different ITO plates, and each point is a measurement for an individual electrode on that plate. All electrodes here have a nominal width of 100 μm .

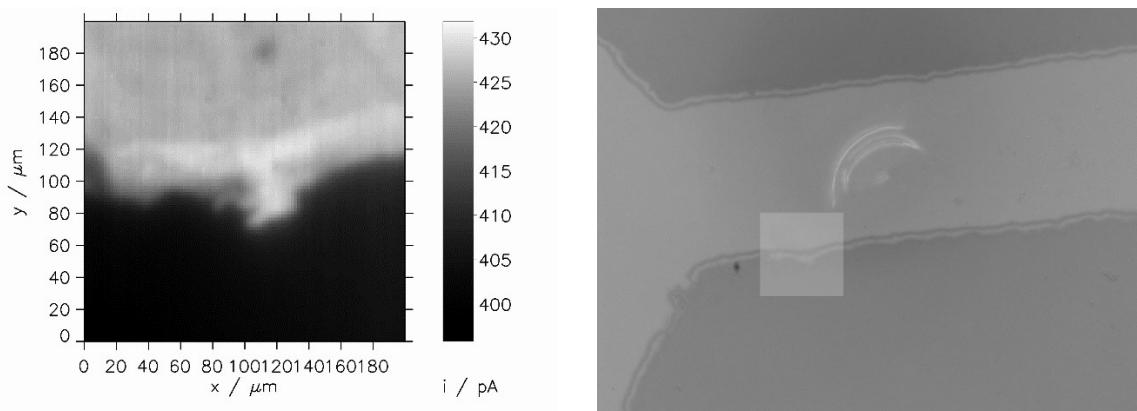


Figure SI 6. SECM image (left) and optical micrograph (right) of etched ITO with highlighted SECM scanning area of $(200 \times 200) \mu m^2$. SECM tip size: $\phi \sim 2.6 \mu m$. Tip-to-sample distance: ca. 325 μm . SECM scanning rate: 33.3 $\mu m s^{-1}$. Electrolyte: aqueous 1 mM ferrocenemethanol in 0.1 M KCl.

Table SI 1. Comparison of different laser ablation methods for fabrication of ITO structures

Laser type	Yb:YAG 1,030 nm	Yb:YAG 1,030 nm	Nd:glass 1,056 nm	KrF excimer laser 248 nm	CO ₂ 10.6μm Direct ablation	CO ₂ 10.6μm Stencil ablation
Model	LXR 100–1030, Luxinar GmbH, Germany	TruMicro2000 system,TRUMPF	femtoREGEN, Spectra-Physics, Inc	Coherent Variolas COMPex Pro 205F	GCC C180II, New Taipei City, Taiwan	GCC C180II, New Taipei City, Taiwan
Power	100 W	20 W	N/A	20 W	30W	30W
Min size of the ablated path	~2μm	~4μm	~10μm	~100μm	~50μm	~100μm
Min. feature width	~2μm	~2μm	N/A	~200μm	~50μm	~100μm
Cost of the laser	~200 000 EUR	High	High	High	12 000 EUR gross	12 000 EUR gross
Availability	Research units	Research units	Research units	Research units	Xerox shops	Xerox shops
Conservation of electrochemical properties	Not tested but resistivity for the patterns in which the ablated section became insulating increased from RS = 3.8 to 200 Ω/sq	Not tested	Not tested	Not tested	Yes	Yes
Reference	¹	²	³	⁴	This work	This work

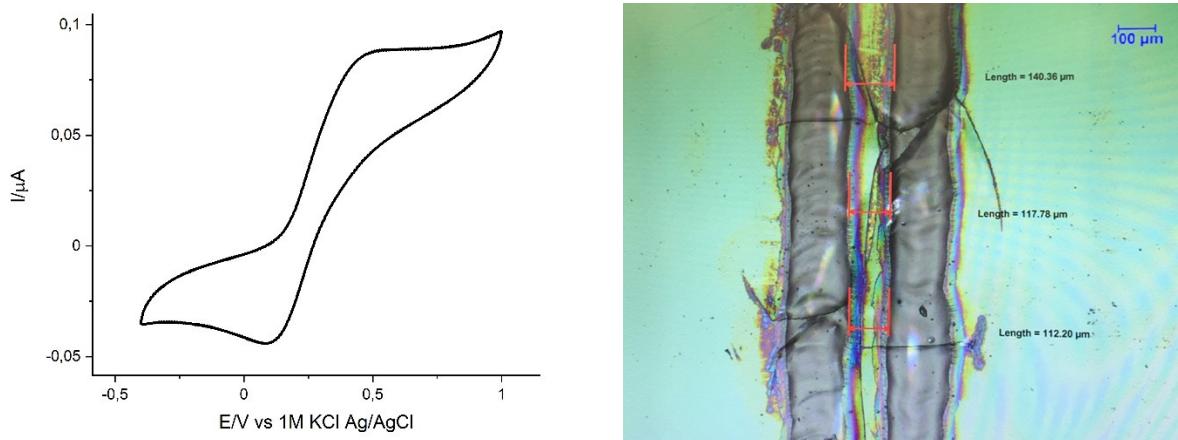


Figure SI 7. Left: Cyclic Voltammogram of a 100 μm wide electrode prepared in a printing shop, right: optical microscopy picture of the electrode.

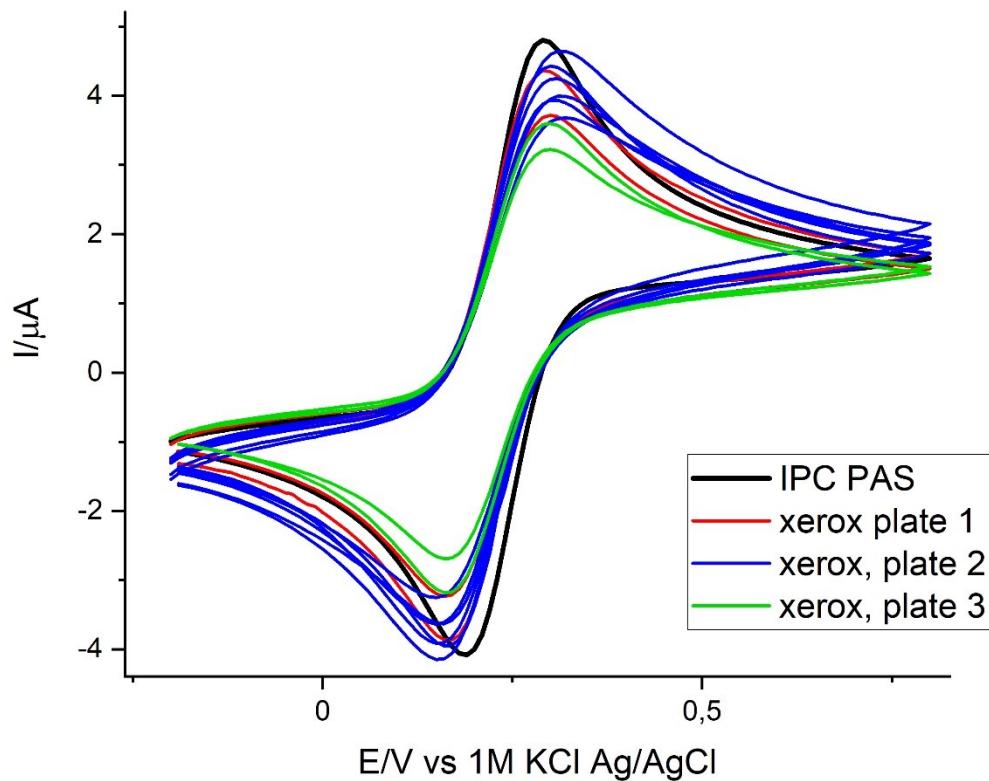
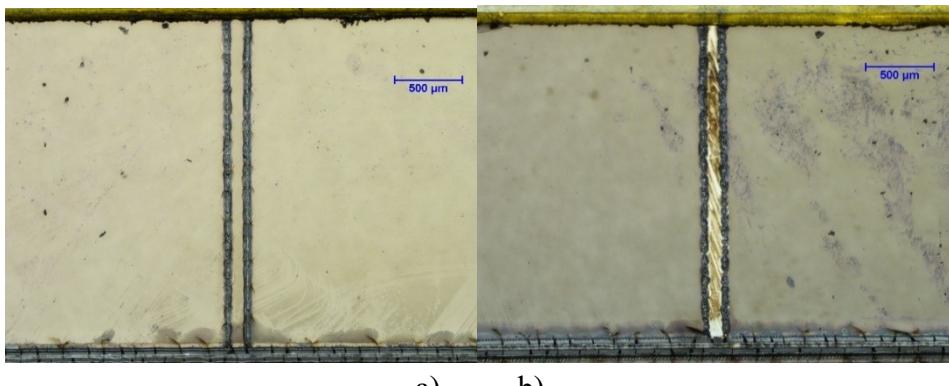


Figure SI 8. Comparison of cyclic voltammograms of the ITO circular electrodes on different plates prepared in a printing shop-each plate marked with a separate color, with the electrode signal prepared in the laboratory setting (black).



a) b)

Fig.SI 9 Microscopic images of a 100 μm electrode a) before and b) after electrochemical treatment to achieve metallic indium and tin.

Bibliography

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