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TECHNOLOGIES

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www.micruxfluidic.com

THINK & INNOVATE

Smart Microfluidic and Electrochemical Solutions for Research Science

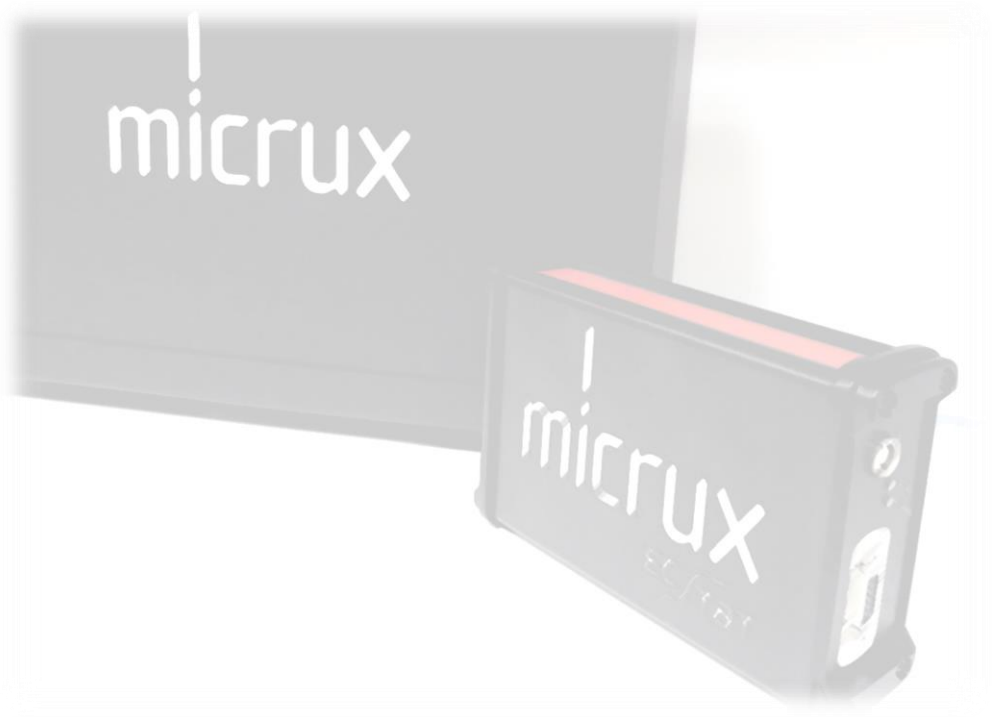
Last update: March 2023

empresa innovadora de base tecnológica reconocida por ANCES eibt

» Presentation

MicruX Technologies is an innovative technology-based company expertise in electrochemistry and microfluidic platforms, founded in 2008 and based in Gijón (Asturias), SPAIN.

MicruX develops miniaturized, automated and portable analysis systems. Thus, Lab-on-a-Chip (LOC) technologies based on microfluidics and electrochemical sensors give rise to the integration of multiple steps carried out in a laboratory (sample pretreatment, mixing, reaction, separation, and detection) on a single device. These miniaturized devices enable the separation, detection, identification and quantification of compounds with analytical interest in real samples. Thus, these novel devices can be used at research and industrial level for developing innovative solutions in food, environment and health sector.



MicruX is proficient in microfluidics and electrochemical detection systems especially designed for research and educational activities. In microfluidic field, MicruX has extensive experience in developing, manufacturing and application of different microfluidic devices. Moreover, our know-how in the electrochemistry field, allow us the design and integration of miniaturized electrochemical sensors on a simple and cost-effective way.

MicruX also provides a new generation of analytical instrumentation in order to make easier the use of the microfluidic and electrochemical devices. Moreover, MicruX has the know-how to provide services for achieving food, environmental and clinical applications using these novel microfluidic and electrochemical devices.

MicruX contributes to make the use of microfluidic and electrochemical devices more routinary in different research fields as well as in industry.

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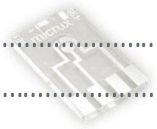
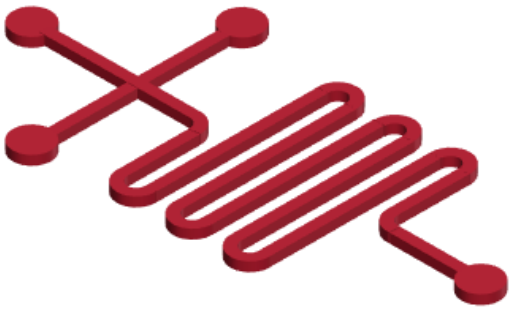




2. ACCESSORIES FOR MICROFLUIDICS & ELECTROCHEMISTRY



Smart Microfluidic & Electrochemical
Solutions for Research Science

1. ELECTROCHEMICAL & MICROFLUIDIC SOLUTIONS

MicruX develops a wide range of standard and customized thick- & thin-film electrodes, microfluidic devices as well as related user-friendly accessories and instrumentation. Electrochemical sensors provide a cost-effective and useful tool for electroanalytical applications, including the development of (bio)sensors.

1.1. THICK-FILM ELECTRODES

MicruX develops thick-film carbon-based electrodes fabricated by printing technologies on flexible and high-resist PET as well as rigid ceramic substrates. These low-cost and disposable electrochemical sensors enable the use of small sample volume.

» Thick-film electrodes main features

» Standard dimensions:	27.5 x 10.1 mm
» Substrate:	PET (white) / Ceramic (Al_2O_3)
» Substrate thickness:	350 µm / 380 µm
» WE area range:	2,3 - 7,1 mm^2
» Sample volume:	20 – 50 µL
» Electrode material:	
Working electrodes (WE1 / WE2):	Carbon / Graphene / Gold
Reference electrode (RE):	Silver or Silver/Silver Chloride
Auxiliary electrode (AE):	Carbon / Graphene / Gold

Printed electrodes are a suitable tool for multiple applications, providing many advantages such as low-cost, disposable, low reagent consumption as well as non-tedious pre-cleaning procedures.

Electroanalysis	Nanotechnology	Biosensors	Flow Analysis Systems
✓ Study EC reactions	✓ Modified electrodes	✓ EC transducers	✓ FIA Systems
✓ Trace EC Analysis	✓ New nanostructures	✓ New recognition elements	✓ Capillary Electrophoresis
✓ In-vivo measurements	✓ New nanomaterials	✓ POC systems	✓ HPLC

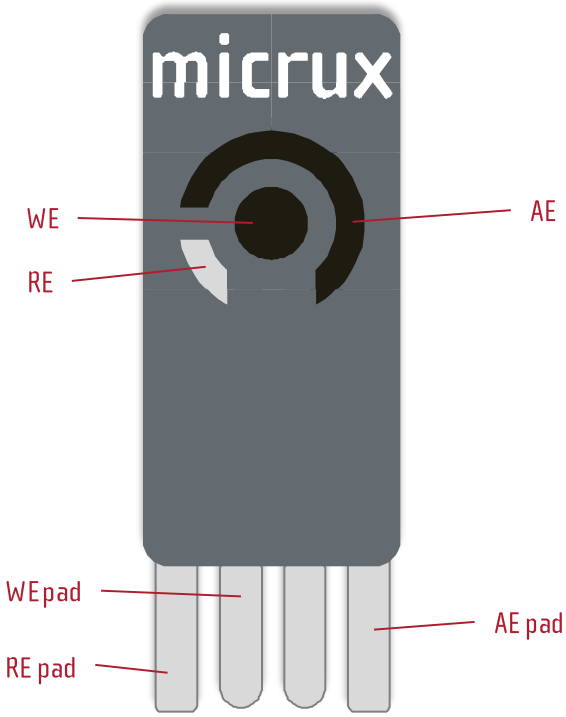
Printed-based electrodes are very useful in order to avoid tedious polishing of traditional solid electrodes, and make easier the development of chemical-sensors and bio-sensors for field analysis.

1.1.1. Thick-film single-electrodes (S1PE)

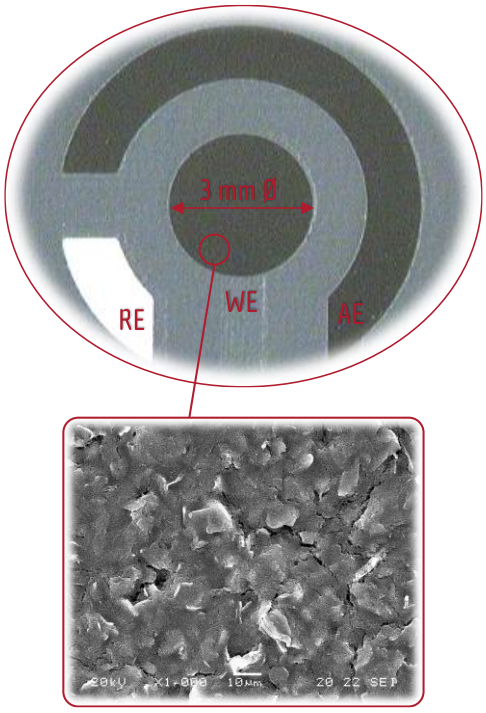
» Thick-film carbon single-electrodes

Carbon (*Ref. ED-S1PE-C*) thick-film electrochemical sensors are based on a classical three-electrodes (working – WE, reference – RE and auxiliary – AE) approach.

» Electrochemical S1PE carbon sensor design



» Electrochemical cell



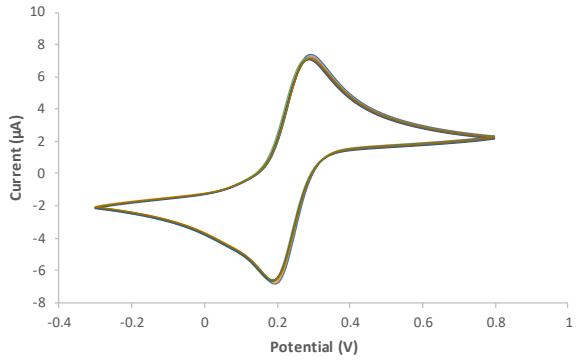
Thick-film carbon-based electrodes are available with different carbon compositions, adapted to the requirements of several applications.

The high-performance (HP) carbon-based screen-printed electrodes (*Ref. ED-S1PE-C1XX*) with an excellent intra- and inter electrode precision are the suitable option for the development of chemical sensors and biosensors.

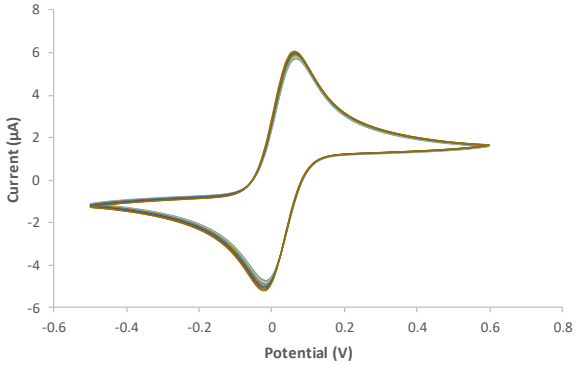
The low-cost (LC) carbon-based screen-printed electrodes (*Ref. ED-S1PE-C2XX*) are the best option for basic electrochemical studies. These electrodes show an excellent electrochemical performance with good reversibility when using cyclic voltammetry.

» Thick-film carbon single-electrodes performance

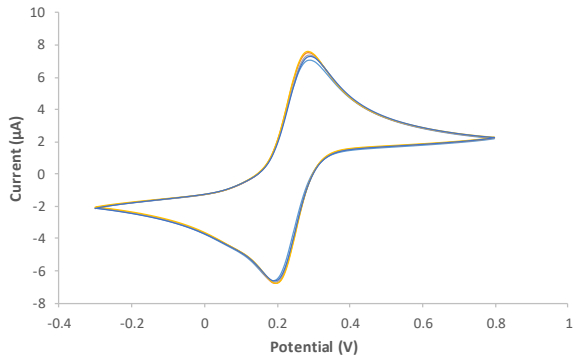
Thick-film carbon-based electrodes show an excellent electrochemical behavior with a good intra- and inter-electrode reproducibility.



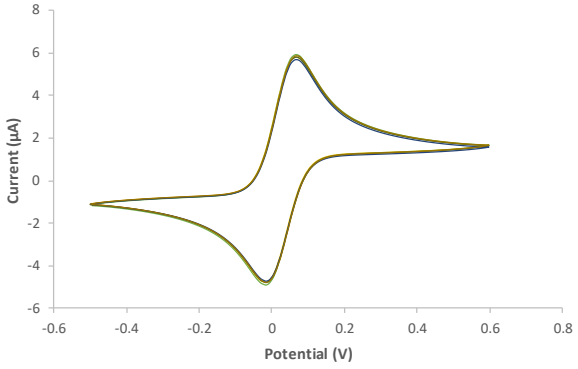
*Successive cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M H_2SO_4 at the **same** thick-film carbon electrode (ED-S1PE-C10). v = 50 mV/s, n = 10, **RSD = 2%***



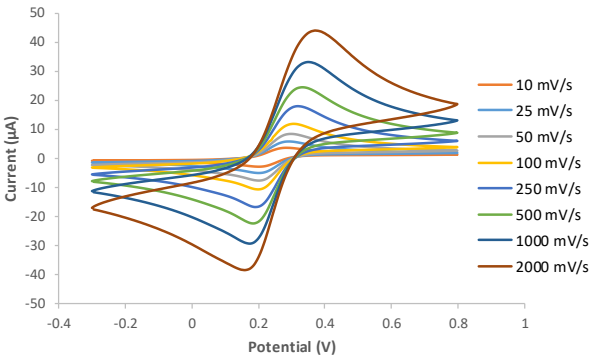
*Successive cyclic voltammograms for 1 mM ferrocene methanol in 0.1 M H_2SO_4 at the **same** thick-film carbon electrode (ED-S1PE-C10). v = 50 mV/s, n = 10, **RSD = 2%***



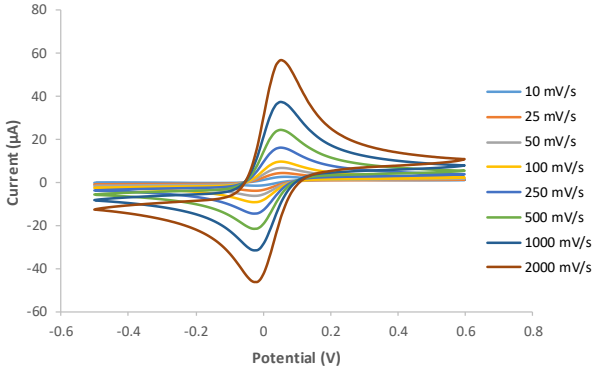
*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M H_2SO_4 at **different** thick-film carbon electrode (ED-S1PE-C10). v = 50 mV/s, n = 10, **RSD = 2%***



*Cyclic voltammograms for 1 mM ferrocene methanol in 0.1 M H_2SO_4 at **different** thick-film carbon electrode (ED-S1PE-C10). v = 50 mV/s, n = 10, **RSD = 2%***



*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M H_2SO_4 using different **scan rates** at a thick-film carbon electrode (ED-S1PE-C10).*

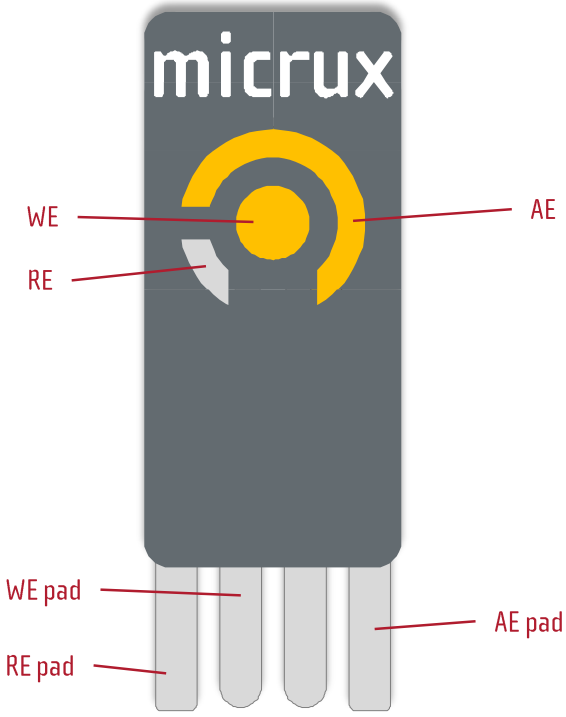


*Cyclic voltammograms for 1 mM ferrocene methanol in 0.1 M H_2SO_4 using different **scan rates** at a thick-film carbon electrode (ED-S1PE-C10).*

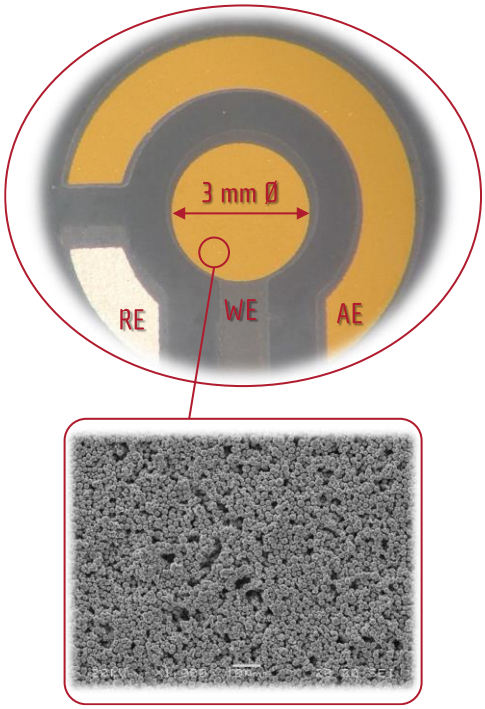
» Thick-film gold single-electrodes

Gold *(Ref. ED-S1PE-Au)* thick-film electrochemical sensors are based on a classical three-electrodes (working – WE, reference – RE and auxiliary – AE) approach.

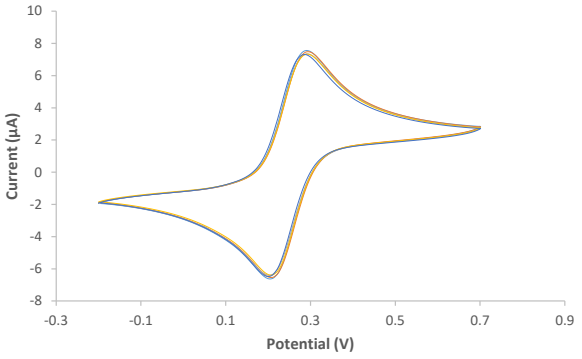
» Electrochemical S1PE gold sensor design



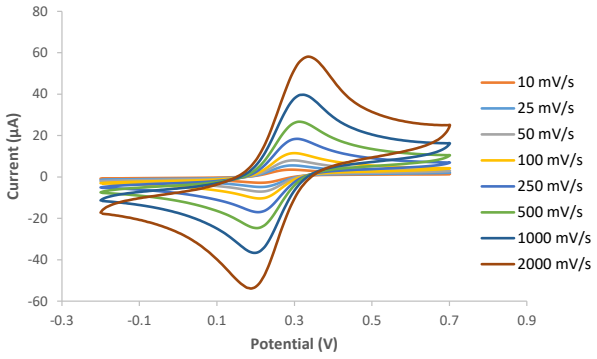
» Electrochemical cell



Thick-film gold-based electrodes show an excellent electrochemical behavior with a good intra- and inter-electrode reproducibility. Gold-based electrodes are very useful for building *self-assembled monolayers* (SAM) and the development of *chemical sensors* and *biosensors*.



*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M H_2SO_4 at **different** thick-film gold electrodes. v = 50 mV/s, n = 5, **RSD = 2%***

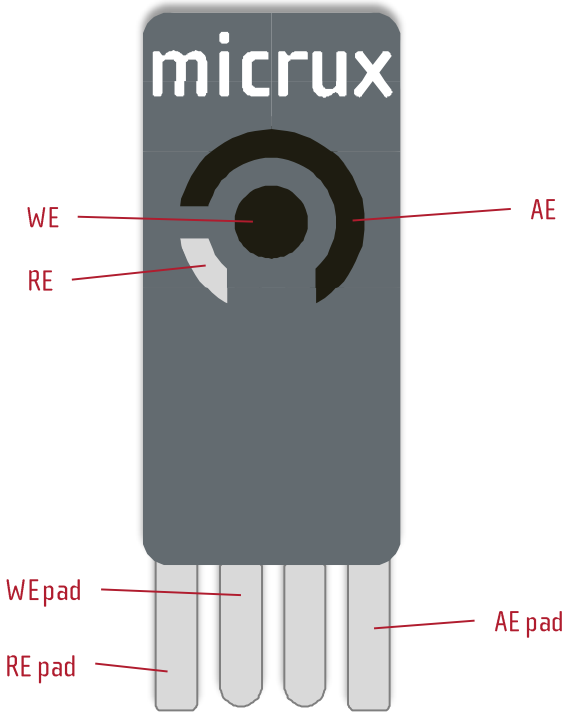


*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M H_2SO_4 using different **scan rates** at a thick-film carbon electrode.*

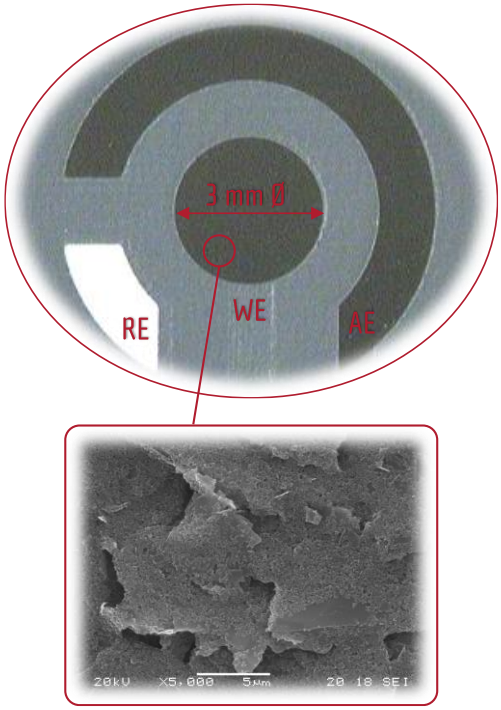
» Thick-film graphene single-electrodes

Graphene *(Ref. ED-S1PE-CG)* thick-film electrochemical sensors are based on a classical three-electrodes (working – WE, reference – RE and auxiliary – AE) approach.

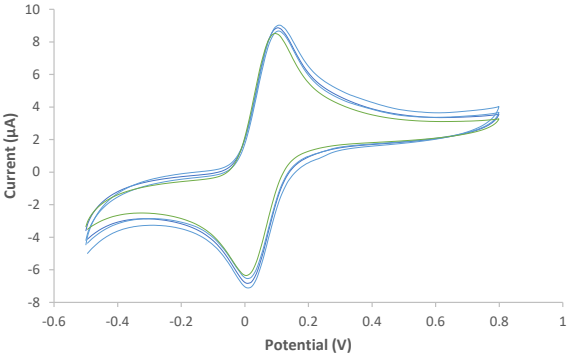
» Electrochemical S1PE sensor design



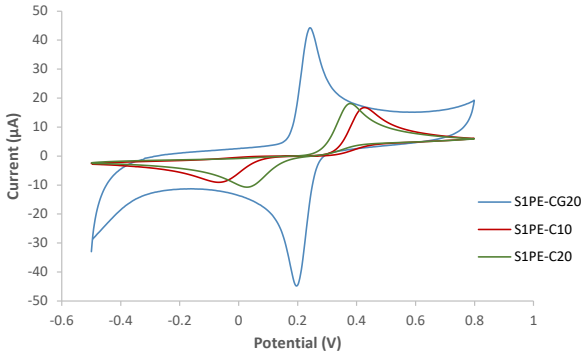
» Electrochemical cell



Thick-film graphene-based electrodes have a very low electrical resistance with a good scratch resistance for using in a wide variety of applications, including the development of low-cost *chemical-sensors* and *bio-sensors* for field analysis.



*Cyclic voltammograms for 1 mM ferrocene methanol in 0.1 M H_2SO_4 at the **same** thick-film graphene electrode. v = 50 mV/s*

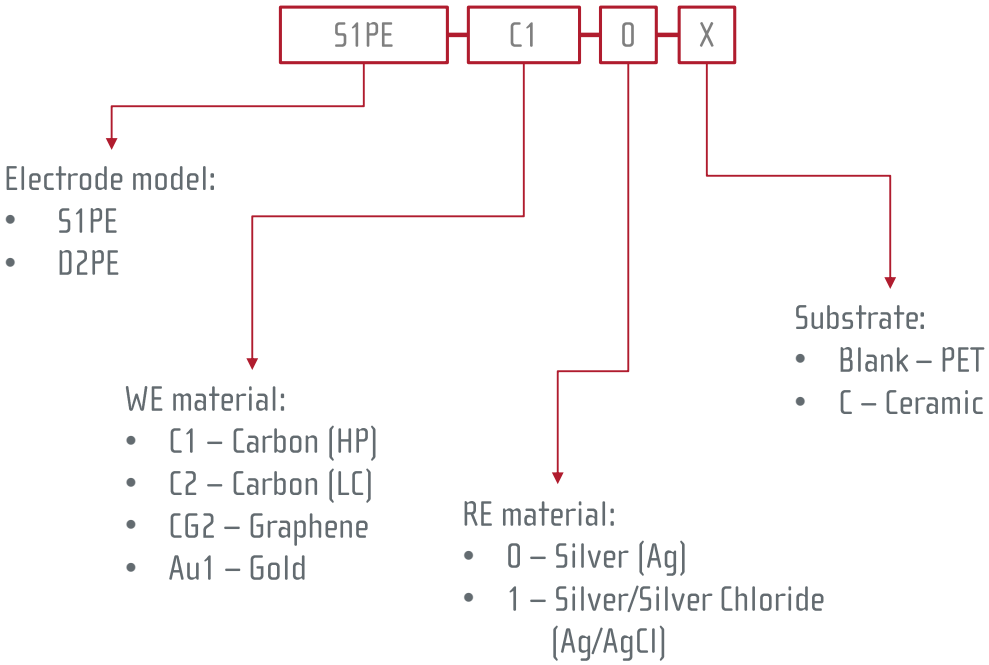


*Cyclic voltammograms for 1 mM hydroquinone in 0.1M H_2SO_4 at different thick-film **carbon** (ED-S1PE-C10 / ED-S1PE-C20) and activated **graphene**-based electrodes (ED-S1PE-CG20). v = 50 mV/s.*

» Thick-film single-electrodes selection

Screen-printed single electrodes (S1PE) are available in different electrode materials and substrates.

SKU	Substrate	WE	RE	AE
» ED-S1PE-C10	PET	Carbon	Silver	Carbon
» ED-S1PE-C10C	Ceramic	Carbon	Silver	Carbon
» ED-S1PE-C20	PET	Carbon	Silver	Carbon
» ED-S1PE-C20C	Ceramic	Carbon	Silver	Carbon
» ED-S1PE-C21	PET	Carbon	Silver/Silver Chloride	Carbon
» ED-S1PE-C21C	Ceramic	Carbon	Silver/Silver Chloride	Carbon
» ED-S1PE-CG20	PET	Graphene	Silver	Graphene
» ED-S1PE-CG21	PET	Graphene	Silver/Silver Chloride	Graphene
» ED-S1PE-Au10	PET	Gold	Silver	Gold
» ED-S1PE-Au10C	Ceramic	Gold	Silver	Gold



Screen-printed electrodes can be easily customized with specific designs and requirements. MicruX has wide experience in the design and development of different thick-film based electrodes. Thus, the electrodes are adapted to fulfill the requirements of customers.

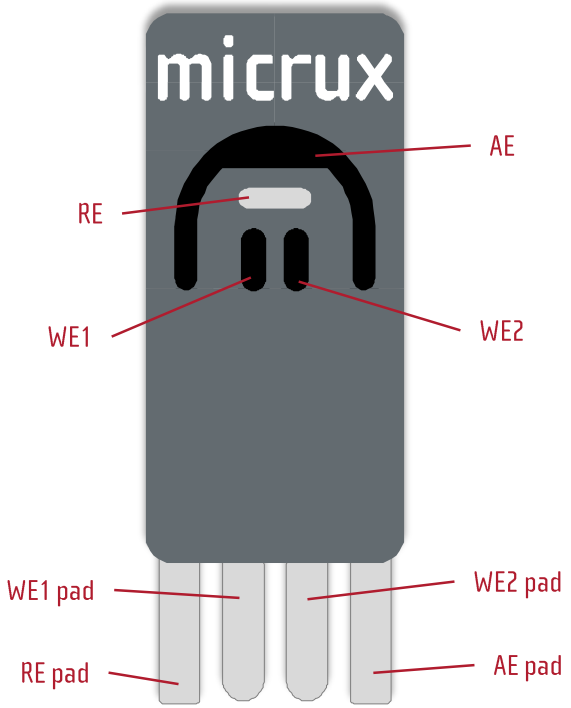
Note: All combinations are NOT available. Please always check the availability for your specific needs.

1.1.2. Thick-film dual-electrodes (D2PE)

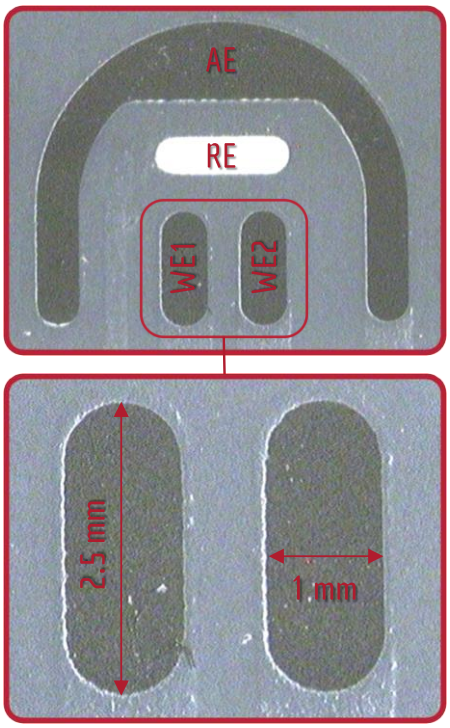
» Thick-film carbon dual-electrodes

Carbon *(Ref. ED-D2PE-C10)* thick-film electrochemical *dual*-sensors are based on a four-electrodes approach with two working electrodes (WE1 / WE2), sharing a reference (RE) and an auxiliary (AE) electrode.

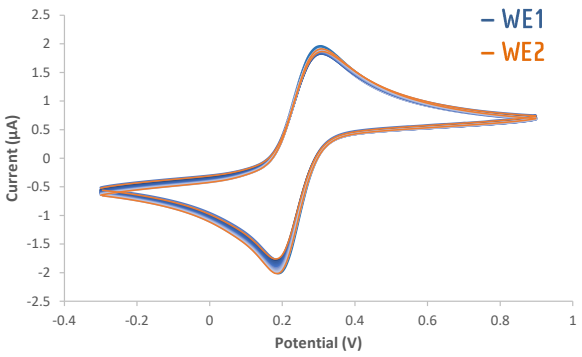
» Electrochemical D2PE sensor design



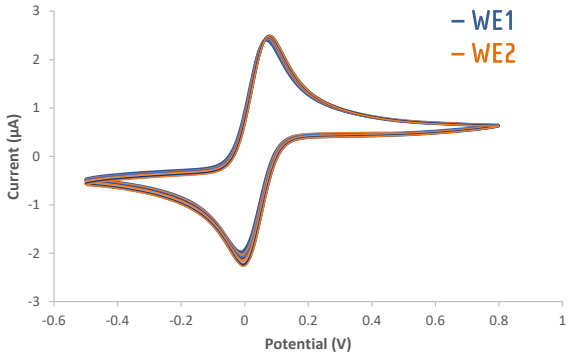
» Dual electrochemical cell



Thick-film carbon dual-electrodes show an excellent electrochemical behavior with a good intra- and inter-electrode reproducibility. Ideal for multiplexing analysis.



*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M H_2SO_4 at thick-film carbon dual-electrodes. v = 50 mV/s, n = 20 (**10** + **10**), **RSD = 2%***

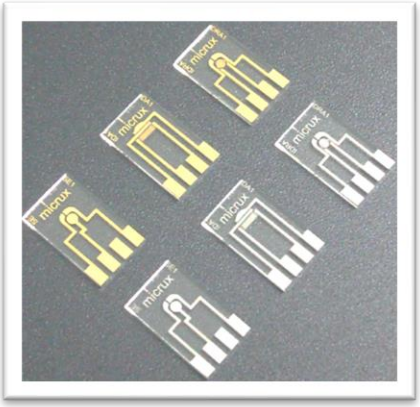


*Cyclic voltammograms for 1 mM ferrocene methanol in 0.1 M H_2SO_4 at thick-film carbon dual-electrodes. v = 50 mV/s, n = 20 (**10** + **10**), **RSD = 2%***

1.2. THIN-FILM ELECTRODES

MicruX develops metal-based (micro)electrodes fabricated by thin-film technologies on a Glass substrate. A SU-8 resin protective layer is used to delimit the electrochemical cell enabling the use of very small sample volume.

» Thin-film electrodes main features



» Standard dimensions:	10 x 6 x 0.75 mm
» Substrate:	Glass
» Protective layer:	SU8/PI resin
» Electrochemical cell:	2 or 3.5 mm Ø
» Sample volume:	1 – 10 µL
» Electrode material:	Platinum or Gold

The inherent properties of the thin-film (micro)electrodes such as low cost & disposables, reusable, high fabrication resolution, high sensitivity, low reagent consumption as well as non-tedious pre-cleaning procedures provide a suitable tool for multiple applications.

Electroanalysis	Flow Systems & Microfluidics	Nanotechnology	Biosensors
✓ Study EC reactions	✓ FIA Systems	✓ Modified electrodes	✓ EC transducers
✓ Trace EC Analysis	✓ Microchips Electrophoresis	✓ New nanostructures	✓ New recognition elements
✓ In-vivo measurements	✓ Capillary Electrophoresis	✓ New nanomaterials	✓ POC systems
✓ Redox cycling	✓ HPLC		

Electrochemical sensors are available in different standard designs and materials.

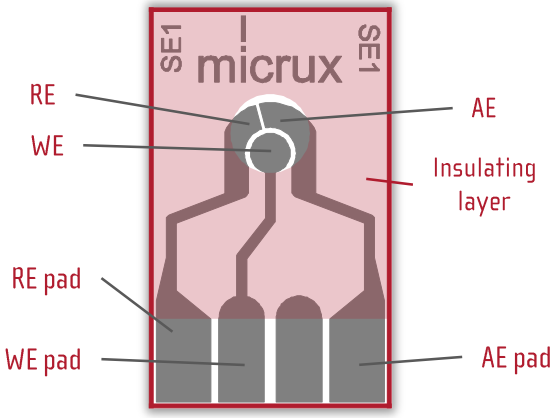
Thin-film technologies can be also used for the manufacture of customized electrochemical sensors. MicruX has wide experience in the design and development of different thin-film based electrodes. Thus, the (micro)electrodes are adapted to fulfill the requirements of customers.

1.2.1. Thin-film single-electrodes (SE)

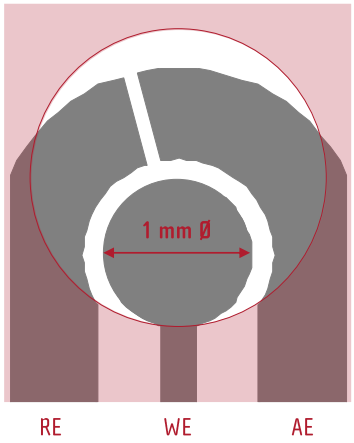
» Thin-film platinum & gold single-electrodes

Electrochemical sensors SE are based on a three-electrode (working - WE, reference - RE and auxiliary - AE) approach. The three electrodes are fabricated in the same material (*platinum* or *gold*) with high precision and resolution.

» Electrochemical SE sensor design

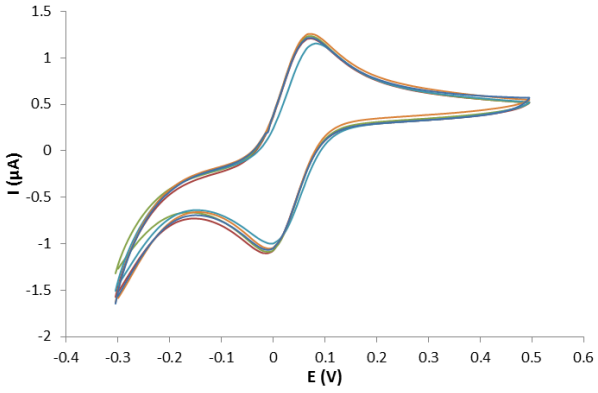


» Electrochemical cell (2 mm Ø)

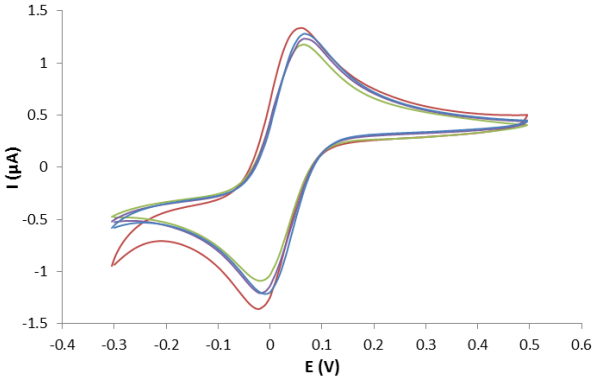


Reference	Electrodes Material	WE size	Electrodes thickness
» *ED-SE1-Pt*	Titanium / Platinum	1mm diameter	50/150 nm
» *ED-SE1-Au*	Titanium / Gold	1mm diameter	50/150 nm

Thin-film metal-based electrodes show an excellent electrochemical behavior with a good intra- and inter-electrode reproducibility.



*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M KCl at **different** thin-film Pt electrodes (**ED-SE1-Pt**). v = 50 mV/s, n = 5, **RSD = 4%***

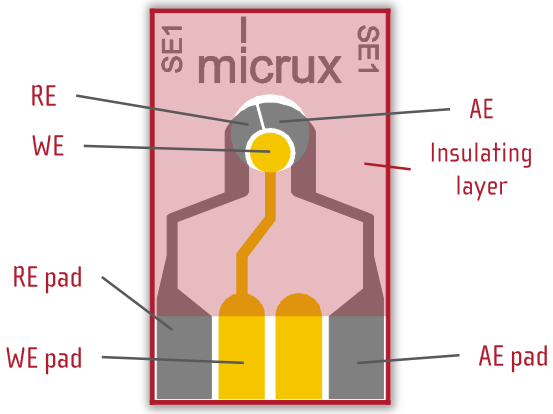


*Cyclic voltammograms for 1 mM ferrocenylmethyl alcohol in 0.05 M H_2SO_4 at **different** thin-film Au electrodes (**ED-SE1-Au**). v = 50 mV/s, n = 4, **RSD = 6%***

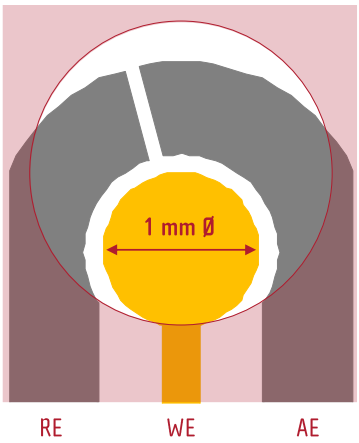
» Thin-film double-metal single-electrodes

Double-metal thin-film electrochemical sensors are based on a three-electrodes approach with a *gold* working electrode (WE) and *platinum* reference (RE) and auxiliary (AE) electrodes. The combination of two different metal electrodes in the same EC cell enables the *modification* of the working electrode surface selectively without affecting the surface of the reference and auxiliary electrodes.

» Electrochemical double-metal SE sensor design

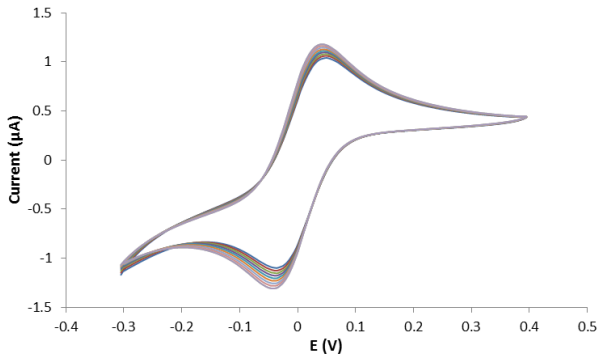


» Electrochemical cell (2 mm Ø)

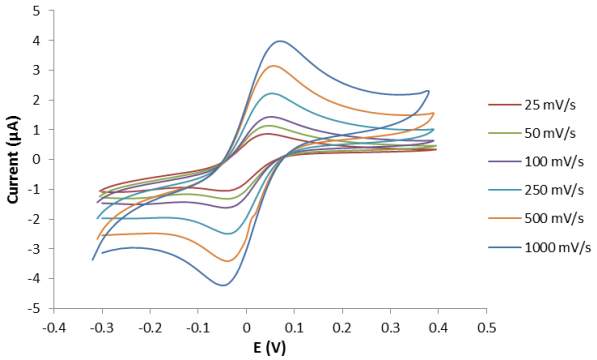


Reference	Electrodes Material *WE*	*RE*	*AE*	WE size	Electrodes thickness
» *ED-SE1-AuPt*	Ti / Au	Ti / Pt	Ti / Pt	1mm diameter	50/150 nm

Thin-film double-metal electrodes show an excellent electrochemical behavior with a good reproducibility.



*Successive cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M KCl at the **same** thin-film Au electrode (**ED-SE1-AuPt**). v = 50 mV/s, n = 10, **RSD = 3%***

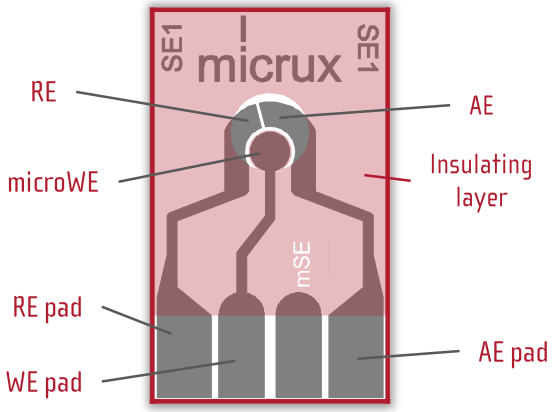


*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M KCl using different **scan rates** at a thin-film Au electrode (**ED-SE1-AuPt**).*

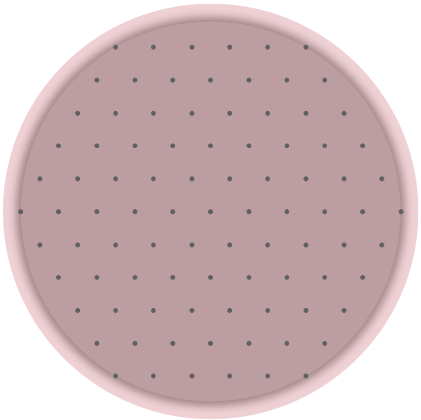
1.2.2. Thin-film microelectrode arrays (MEA)

Thin-film technologies enable the development of small microstructures (<25 µm) with high resolution and precision. Thus, a microelectrode array (MEA) based on pinholes with a honeycomb microstructure can be manufactured on a working single-electrode.

» Electrochemical mSE sensor design



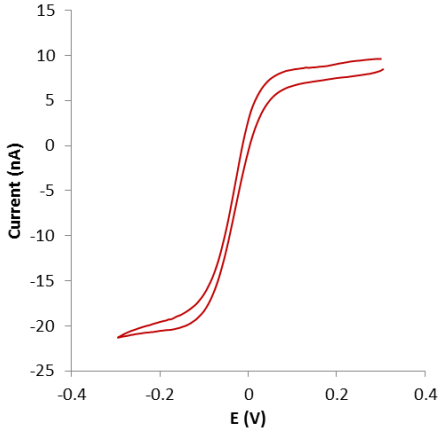
» Electrochemical cell – Working Microelectrode Array



The working electrode (*1 mm diameter*) is based on a metal surface coated with SU-8 resin in which is defined a microholes array with honeycomb structure.

Reference	Electrodes Material	Working Electrode Microstructure µHoles diameter	µHoles pitch	µHoles number	Electrodes thickness
» *ED-mSE-5-Pt*	Ti / Pt	5 µm	50 µm	500	50/150 nm
» *ED-mSE-10-Pt*	Ti / Pt	10 µm	100 µm	90	50/150 nm
» *ED-mSE-5-Au*	Ti / Au	5 µm	50 µm	500	50/150 nm
» *ED-mSE-10-Au*	Ti / Au	10 µm	100 µm	90	50/150 nm

Thin-film MEA electrodes show the typical microelectrode behavior to enhance the analytical signals by reaching the steady-state in a short time.



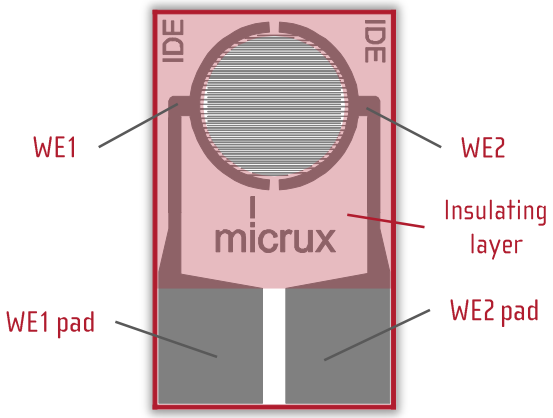
*Cyclic voltammogram for 1 mM ferrocenylmethyl alcohol in 0.1 M H_2SO_4 at a thin-film **gold** microelectrode array (**ED-mSE-10-Au**). v = 10 mV/s.*

Electrode pre-cleaning by cyclic voltammetry between -1.5V and +1.5 V (n = 10, v = 100 mV/s) – BGE: 0.1 M H_2SO_4.

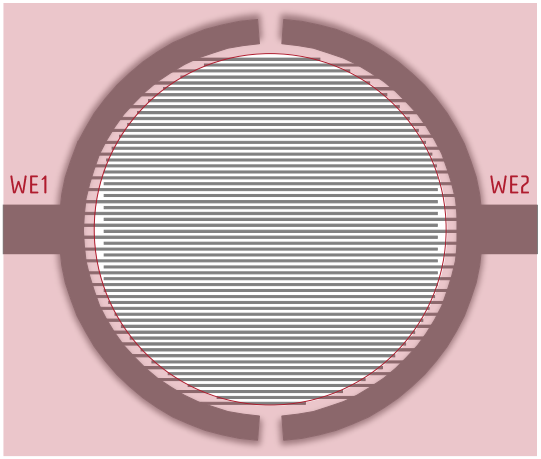
1.2.3. Thin-film interdigitated electrodes (IDE)

Thin-film technologies enable the fabrication of microelectrodes (<25 µm) with high resolution and precision. The most basic interdigitated electrodes (IDE) consist of two individually addressable microelectrode array strips with an interdigitated approach. Non-additional reference and auxiliary electrodes are included on the device.

» Electrochemical IDE sensor design



» Electrochemical cell (3.5 mm Ø)



Different interdigitated electrode (IDE) designs are available in platinum or gold.

Reference	Material	µElectrode width	µElectrode gap	Number of feet	Thickness
» *ED-IDE1-Pt*	Ti/Pt	10 µm	10 µm	90 pairs	50/150 nm
» *ED-IDE2-Pt*	Ti/Pt	10 µm	5 µm	120 pairs	50/150 nm
» *ED-IDE3-Pt*	Ti/Pt	5 µm	5 µm	180 pairs	50/150 nm
» *ED-IDE1-Au*	Ti/Au	10 µm	10 µm	90 pairs	50/150 nm
» *ED-IDE2-Au*	Ti/Au	10 µm	5 µm	120 pairs	50/150 nm
» *ED-IDE3-Au*	Ti/Au	5 µm	5 µm	180 pairs	50/150 nm

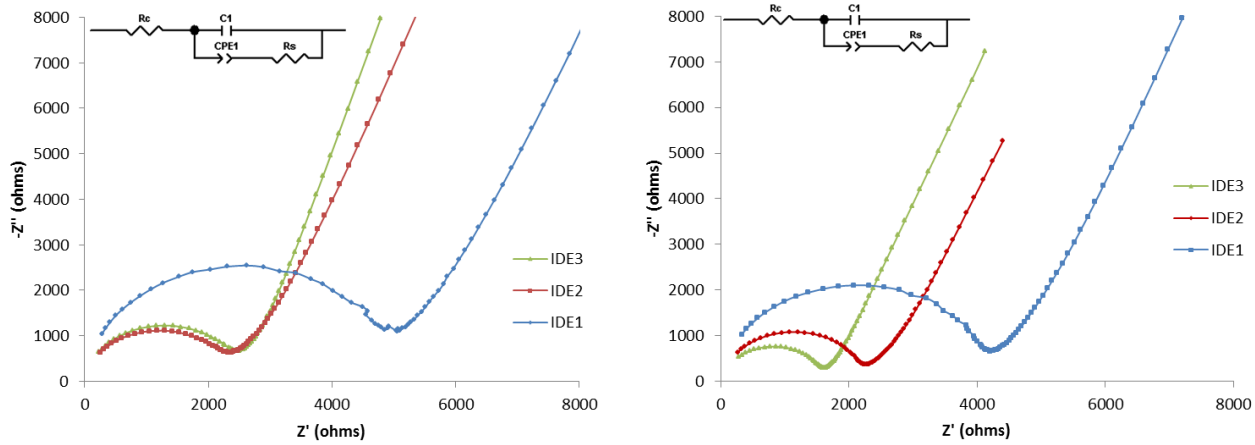
These lineal-band electrodes have been specially designed in a circular cell to work with very small sample drops (< 10 µL). The sample drop shape is well-adapted to the electrode cell in order to get the maximum performance and precision.

The interdigitated electrodes (IDE) provide a suitable tool especially useful for impedance, capacitance and conductivity measurements as well as fuel cells.

Electrochemical Impedance Spectroscopy (EIS) is a powerful, fast and accurate non-destructive method that can be used with the interdigitated electrodes (IDE) in multiple analytical applications.

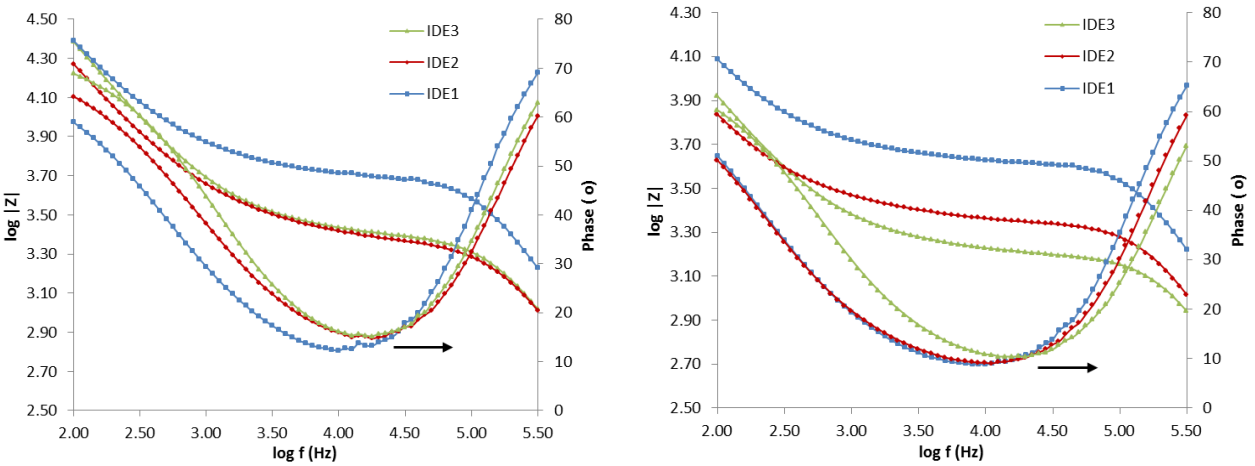
» Gold thin-film interdigitated electrodes » Platinum thin-film interdigitated electrodes

Nyquist Plots



*Nyquist plots using **different** gold and platinum thin-film **interdigitated electrodes** in a low conductivity NaCl solution (6.0 mS/cm). Frequencies range: 500 kHz – 100 Hz, V_{p-p} = 25 mV. **Inset:** equivalent electric circuit.*

Bode Plots



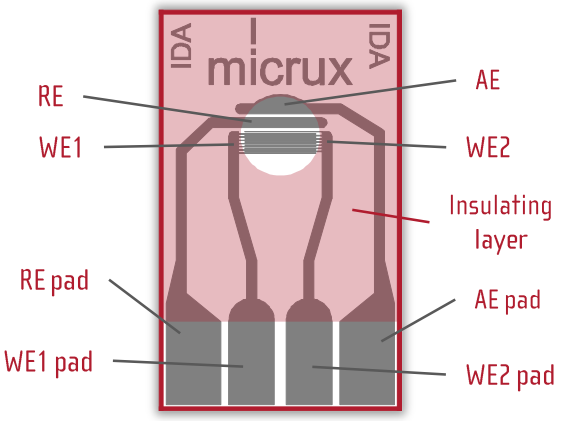
*Bode plots using **different** gold and platinum thin-film **interdigitated electrodes** in a low conductivity NaCl solution (6.0 mS/cm). Frequencies range: 500 kHz – 100 Hz, V_{p-p} = 25 mV.*

Impedance spectra data were provided by Nanobiotechnology for Diagnostics (Nb4D**) Group from Advanced Chemical Research Institute of Catalonia (IQAC-CSIC), Biomedical Research Networking Center in Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN), Barcelona, SPAIN.*

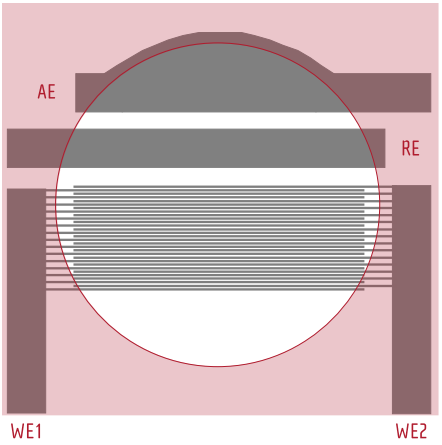
1.2.4. Thin-film interdigitated microelectrode array (IDA)

Thin-film technologies enable the integration of the *reference* (RE) and *auxiliary* (AE) electrodes with the interdigitated microelectrodes. Interdigitated array (IDA) electrodes take also advantages of the microelectrodes features enhancing the *sensitivity* and *detection limits*. In this case, the working electrode (WE) consists of two individually addressable arrays of microelectrodes with an interdigitated approach.

» Electrochemical IDA sensor design



» Electrochemical cell (2 mm Ø)

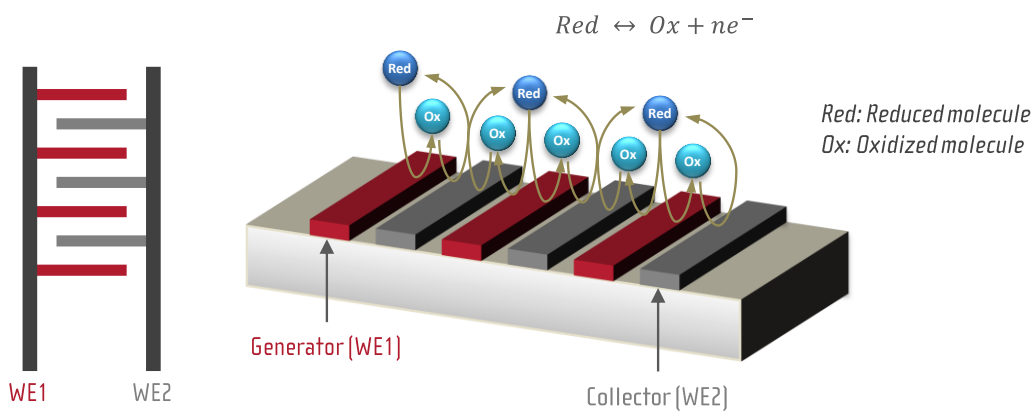


» IDA working electrode

Different IDA microelectrode (WE1/WE2) designs are available in platinum or gold.

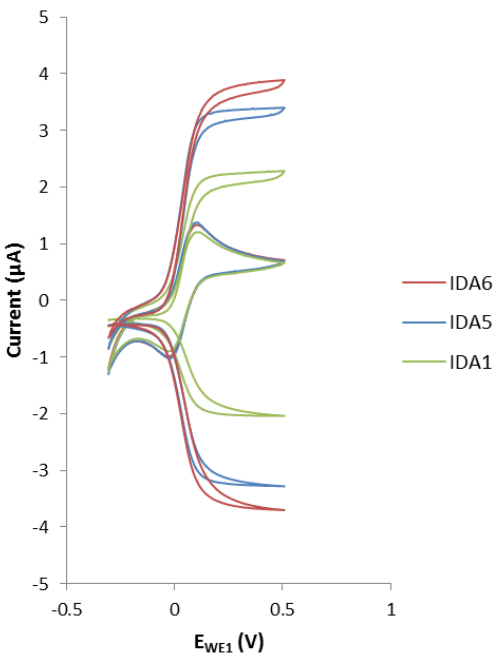
Reference	Material	µElectrode width	µElectrode gap	Number of feet	Thickness
» *ED-IDA1-Pt*	Ti/Pt	10 µm	10 µm	15 pairs	50/150 nm
» *ED-IDA5-Pt*	Ti/Pt	10 µm	5 µm	20 pairs	50/150 nm
» *ED-IDA6-Pt*	Ti/Pt	5 µm	5 µm	30 pairs	50/150 nm
» *ED-IDA1-Au*	Ti/Au	10 µm	10 µm	15 pairs	50/150 nm
» *ED-IDA5-Au*	Ti/Au	10 µm	5 µm	20 pairs	50/150 nm
» *ED-IDA6-Au*	Ti/Au	5 µm	5 µm	30 pairs	50/150 nm

Thin-film IDA electrodes could be used in ***single-*** (only one WE, *generator*, is connected) or ***dual-mode*** (both WEs, *generator* and *collector*, are connected). Dual-mode enables the microelectrode behavior, reaching the steady-state in a short time and enhancing the analytical signals.

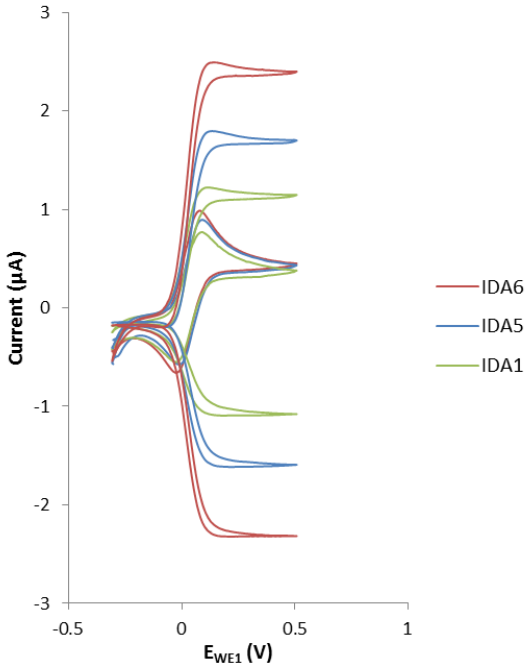


Redox cycling performed at Interdigitated Array (IDA) microelectrodes

IDA microelectrode designs *(width and gap)* are going to affect the number of *redox cycling* as well as the *collection efficiency*.



*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M KCl using **single-** and **dual-mode** at different Platinum IDA electrodes*



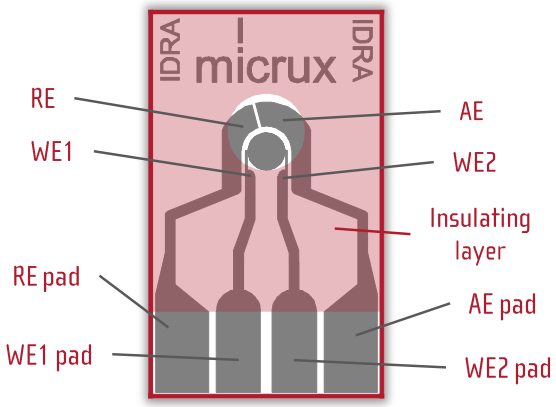
*Cyclic voltammograms for 1 mM ferrocene methylalcohol in 0.1 M H_2SO_4 using **single-** and **dual-mode** at different Gold IDA electrodes.*

***Generator (WE1)** potential cycled from-0.3 to 0.5 V at 50 mV/s. **Collector (WE2)** potential held constant at-0.3 V (dual-mode).*

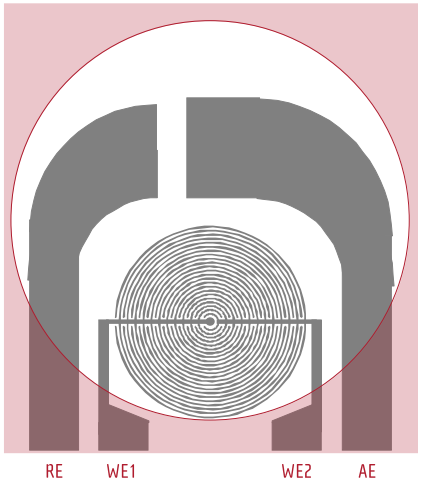
1.2.5. Thin-film interdigitated ring array (IDRA)

Thin-film technologies open the gate to develop special microelectrodes designs. Interdigitated ring array (IDRA) electrodes bring a radial design specially focused on flow systems. The working electrode consists of two radial arrays of microelectrodes with an interdigitated approach.

» Electrochemical IDRA sensor design



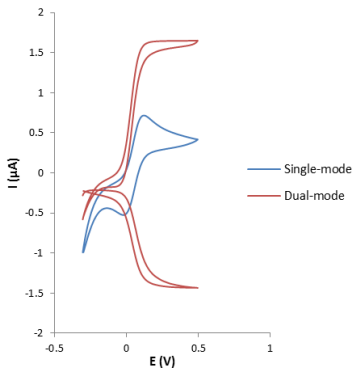
» Electrochemical cell (2 mm Ø)



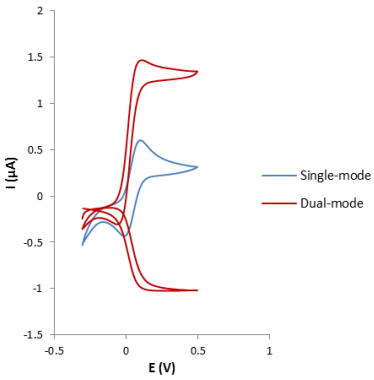
» IDRA working electrode

Reference	Material	µElectrode width	µElectrode gap	Number of feet	Thickness
» *ED-IDRA1-Pt*	Ti/Pt	10 µm	10 µm	12 pairs	50/150 nm
» *ED-IDRA1-Au*	Ti/Au	10 µm	10 µm	12 pairs	50/150 nm

Dual-mode enables the microelectrode behavior, reaching the steady-state in a short time and enhancing the analytical signals



*Cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M KCl using single- and dual-mode at a **Platinum** IDRA electrode.*



*Cyclic voltammograms for 1 mM ferrocene methylalcohol in 0.1 M H_2SO_4 using single- and dual-mode at a **Gold** IDRA electrode.*

1.2.6. On-demand thin-film electrochemical sensors

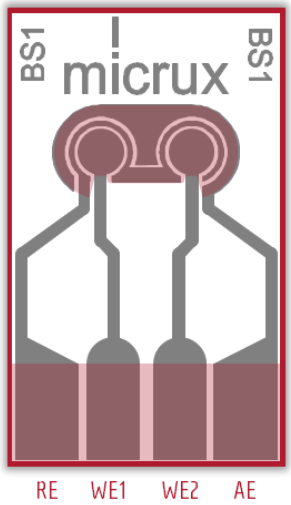
MicruX is able to manufacture *off–the–shelf* metal-based thin-film (micro)electrodes as well as other *pre-designed sensors* on-demand. Different *on-demand sensors* are currently available to be manufactured. Metal-based (micro)electrodes are manufactured on a glass substrate with SU-8 resin as insulating layer, delimiting the electrochemical cell.

» Basic Single- & Multi-Electrode Systems

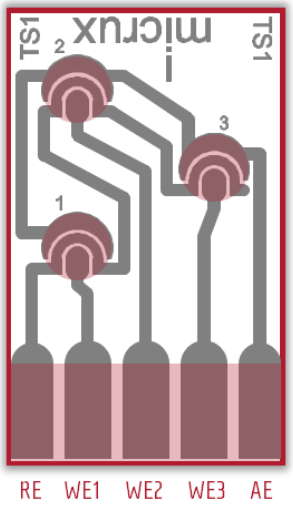
Different single- and multi-electrode chips, integrating one or more working electrodes (WE) as well as reference (RE) and auxiliary (AE) electrodes, are easily manufactured by using thin-film technologies. Electrodes are available in gold and platinum.

» Single-Sensor

» Dual-Sensor



» Tri-Sensor

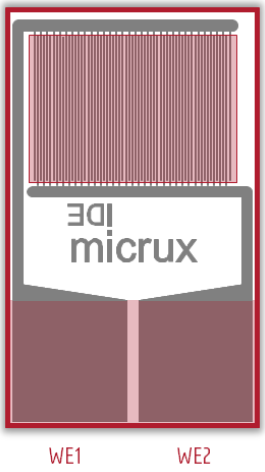


more info

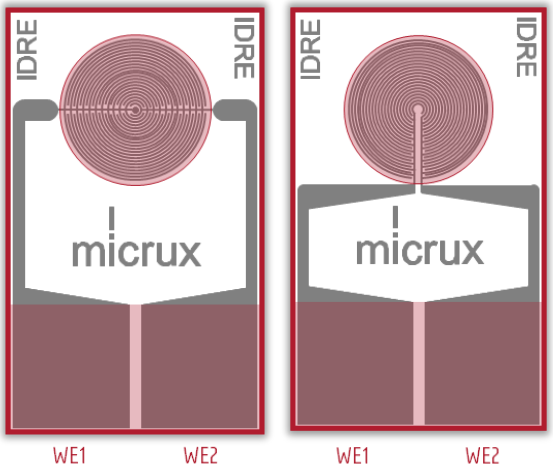
» Basic Interdigitated Lineal & Ring Electrodes

Different lineal (IDE) and ring (IDRE) approaches are available for the basic interdigitated electrodes. Interdigitated electrodes consist of two individually addressable microelectrode array strips.

» IDE sensors



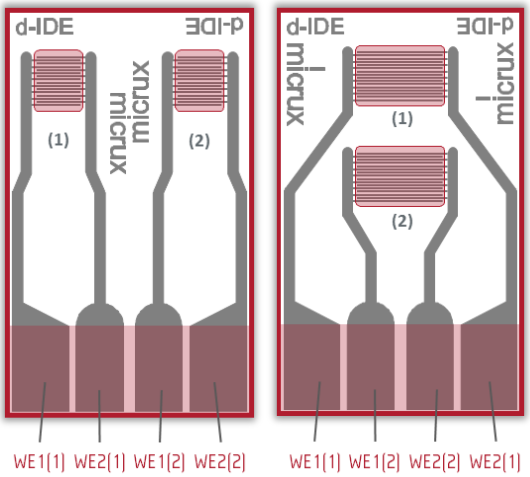
» IDRE sensors



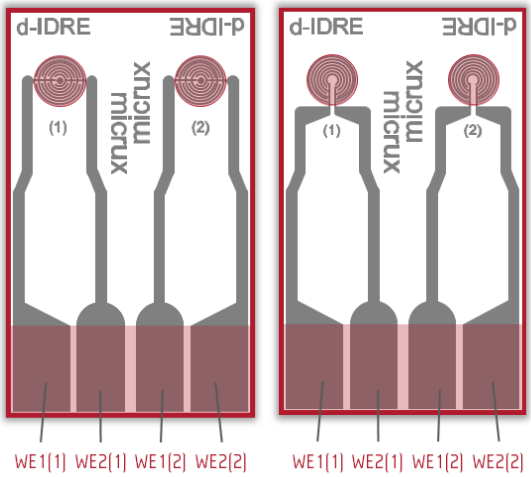
» Dual Interdigitated Lineal & Ring Electrodes

Dual interdigitated electrodes (lineal or ring) can be integrated in a single chip with different configurations.

» Dual-IDE sensors



» Dual-IDRE sensors

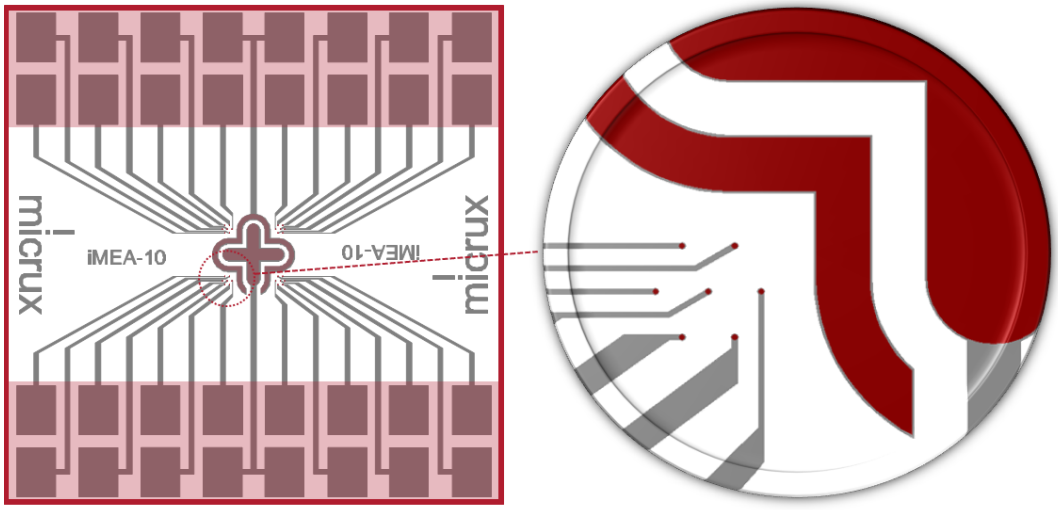


more info

» Individually Addressable MicroElectrode Arrays

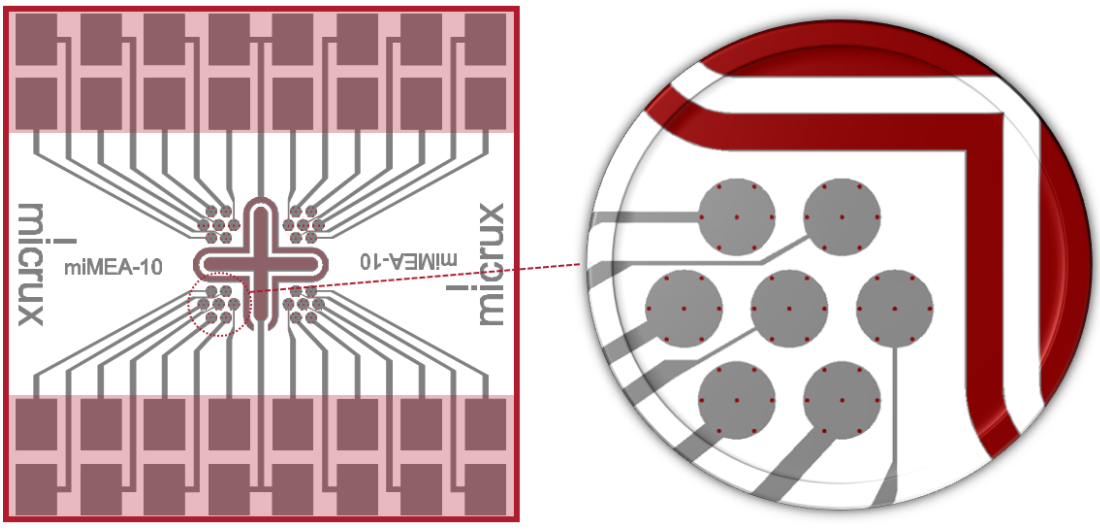
Thin-film technologies enable the manufacture of different individually addressable multi-electrode array (iMEA) systems.

» iMEA chip



iMEA chip consists of four sets of seven 10-µm microelectrodes (28 individually addressable microelectrodes) with integrated reference and auxiliary electrodes in the center of the chip.

» multi-iMEA chip

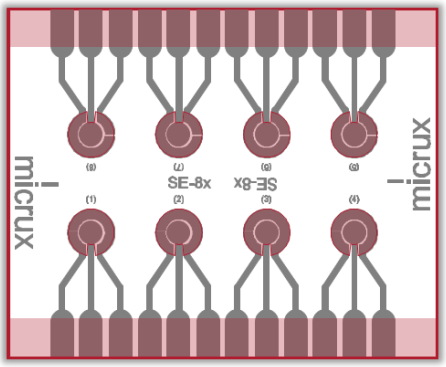


Multi-iMEA chip consists of four areas with seven sets of seven 10-µm microhole arrays (28 individually addressable microelectrode arrays) with integrated reference and auxiliary electrodes in the center of the chip.

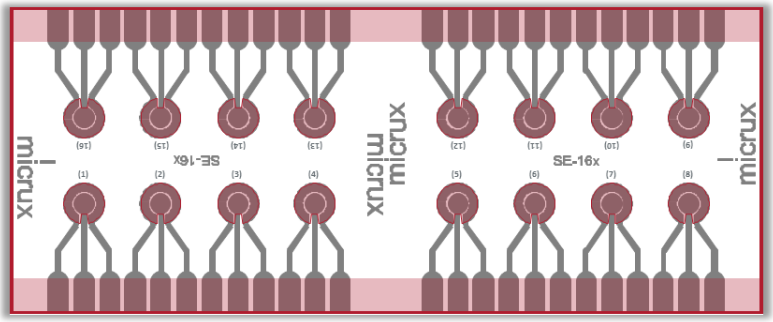
» Multi-Electrodes Chips

Thin-film technologies enable the integration of multiple electrochemical cells in a single chip for multiplexing detection.

» 8x single-electrode chip



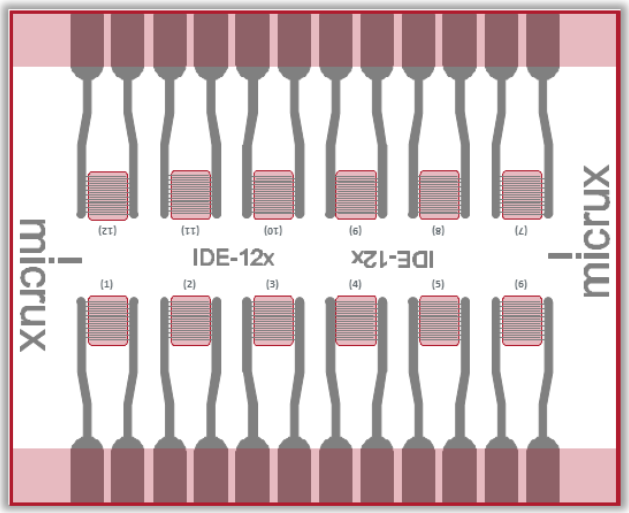
» 16x single-electrode chip



» Multi Interdigitated Electrodes Chips

Thin-film technologies also enable the integration of multiple cells with interdigitated electrodes in a single chip for multiplexing detection.

» Multi-IDE chip



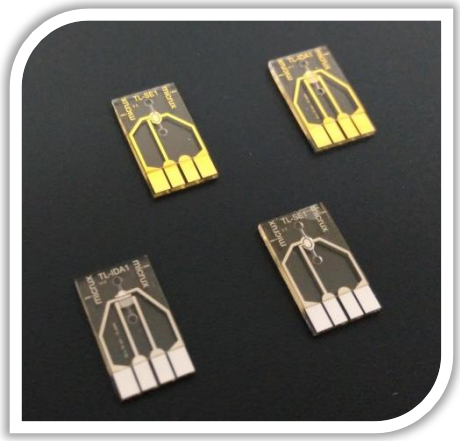
more info

1.3. MICROFLUIDIC ELECTROCHEMICAL SENSORS

MicruX develops full-integrated microfluidic electrochemical sensors. Microfluidics and electrochemical sensors are integrated in a single chip by using thin-film technologies. Integrated thin-layer hybrid SU-8/Glass chips offer a suitable analytical solution for multiple applications.

» Thin-layer microfluidic sensor features

The basic microfluidic structure consists of a single-channel manufactured in SU-8 resin on a glass substrate containing the metal-based (micro)electrodes.



» External dimensions:	10 x 6 x 0.8 mm
» Substrate:	Glass
» Microfluidic stage:	SU-8 resin
» Channel width:	250 µm / 1 mm *(EC cell)*
» Channel height:	40 µm
» Channel volume:	55 nL
» Inlet / outlet:	0.7 mm Ø
» Electrode material:	Platinum or Gold

Integrating microfluidics with electrochemical sensors allow to improve the control of fluids on the electrode surface. Microfluidic electrochemical sensors are used as thin-layer based flow-cell in flow injection analysis (FIA) systems. Microfluidics enable the accurate control of low sample/ reagents volume *(55 nL internal channel volume)* through the electrodes. It offers several advantages for the modification of the electrode surface and the development of chemical sensors and biosensors.

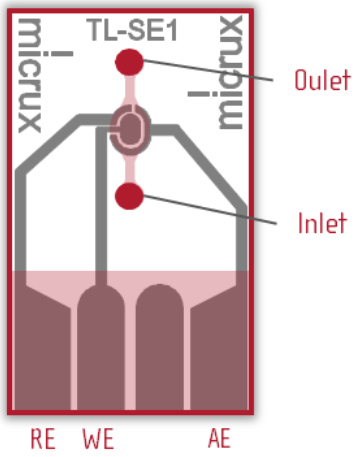
» Thin-layer accessories

Microfluidic sensors are compatible with the innovative All-in-One (AIO) platform *(see electrochemical platforms).* A special add-on has been developed for using the microfluidic electrochemical sensors in a flow system with a thin-layer approach. The thin-layer based flow-cell improves the control of fluids getting better precision with lower dead volume and low sample requirements.

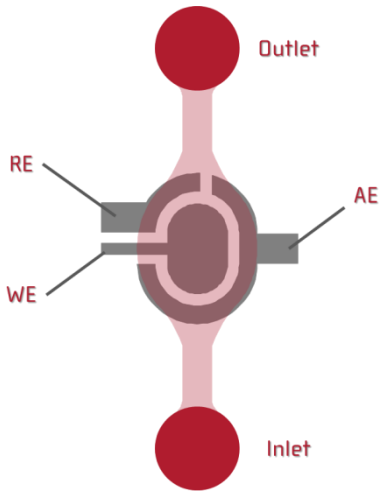
1.3.1. Thin-layer microfluidic single sensor

A basic three-electrode system is integrated easily in the microfluidic chips by thin-film technologies. The working electrode is placed in the center of the single-microchannel to get the highest performance.

» Microfluidic single sensor design

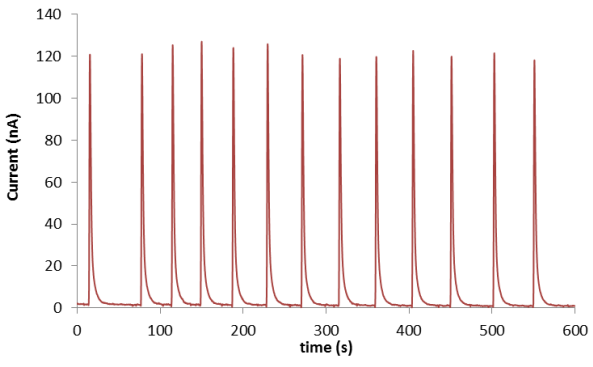


» Microfluidic Electrochemical cell

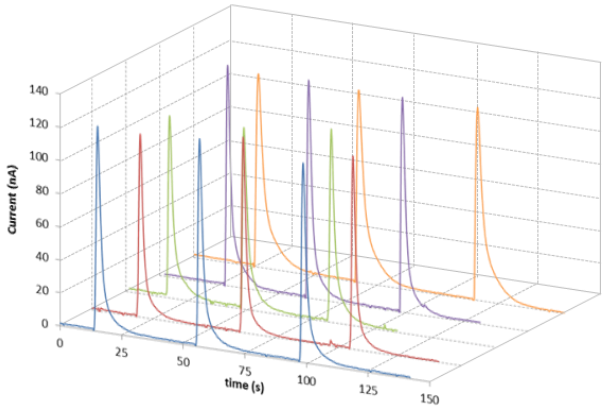


Reference	Electrodes Material	WE area	Electrodes thickness
» *TL-5E1-Pt*	Ti / Pt	0.3 mm^2	50/150 nm
» *TL-5E1-Au*	Ti / Au	0.3 mm^2	50/150 nm

Microfluidic single sensors can be used in a flow injection analysis (FIA) system with a thin-layer approach. Thin-layer based flow cells can improve the reproducibility and sensitivity in multiple analytical applications.



Successive injections of $1 \cdot 10^{-5}$ M pAP in a FIA system using a thin-layer microfluidic single platinum electrode (TL-SE1-Pt). RSD = 2%, n = 13.



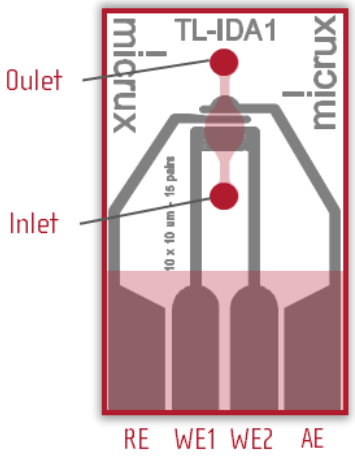
Amperometric response for $1 \cdot 10^{-5}$ M pAP in a FIA system using different thin-layer microfluidic chips (TL-SE1-Pt).

Carrier: 0.1 M PBS, pH = 7.4, flow rate = 1.0 mL/min, E_d = +0.4 V.

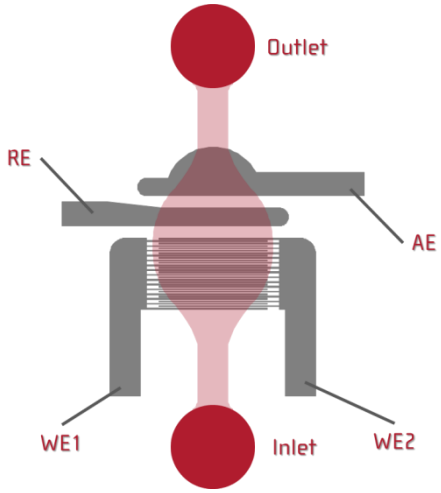
1.3.2. Thin-layer microfluidic interdigitated array sensor

Interdigitated array electrodes are integrated in the microfluidic chips by thin-film technologies. The working electrode (WE) consists of two individually addressable arrays of microelectrodes with an interdigitated approach.

» Microfluidic interdigitated sensor design



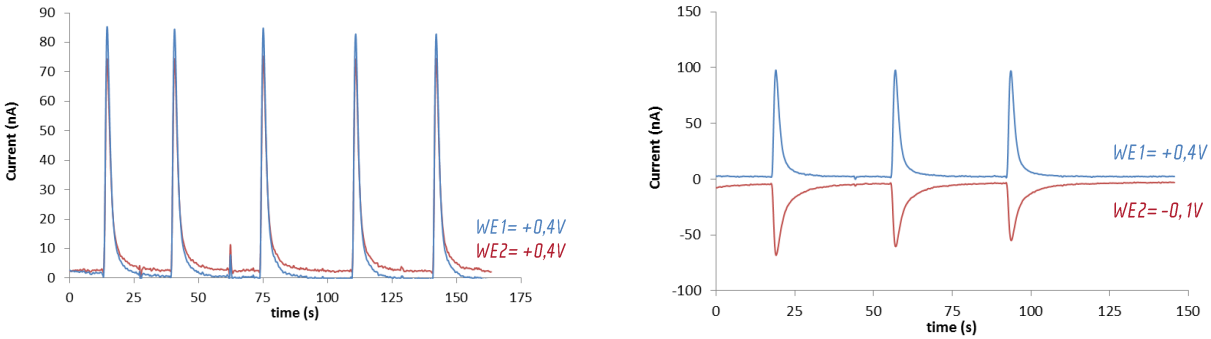
» Microfluidic Electrochemical cell



» IDA working electrode

Reference	Material	µElectrode width	µElectrode gap	Number of feet	Thickness
» *TL-IDA1-Pt*	Ti/Pt	10 µm	10 µm	15 pairs	50/150 nm
» *TL-IDA1-Au*	Ti/Au	10 µm	10 µm	15 pairs	50/150 nm
» *TL-IDA5-Pt*	Ti/Pt	5 µm	5 µm	30 pairs	50/150 nm
» *TL-IDA5-Au*	Ti/Au	5 µm	5 µm	30 pairs	50/150 nm

Microfluidic interdigitated sensors enable the use of the same or different detection potential simultaneously in a thin-layer based flow analysis system. Interdigitated sensors can enhance the sensitivity and selectivity of the analytical systems.



Amperometric response for 1·10^{-5} M pAP in a FIA system using a thin-layer microfluidic interdigitated array platinum electrode (TL-IDA1-Pt) applying same and different detection potentials. Carrier: 0.1 M PBS, pH = 7.4, flow rate = 1.0 mL/min.

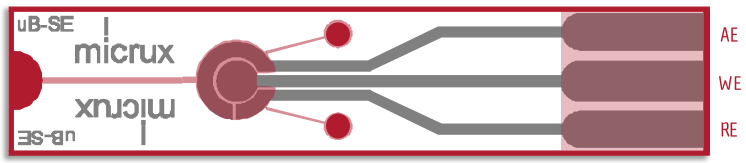
1.3.3. On-demand microfluidic electrochemical sensors

MicruX is able to manufacture *off–the–shelf* microfluidic devices with integrated metal-based thin-film (micro)electrodes as well as other *pre-designed* microfluidic sensors *on-demand*. Different *on-demand microfluidic sensors* are currently available to be manufactured. Metal-based (micro)electrodes are manufactured on a glass substrate integrating a microfluidic stage on SU-8 resin.

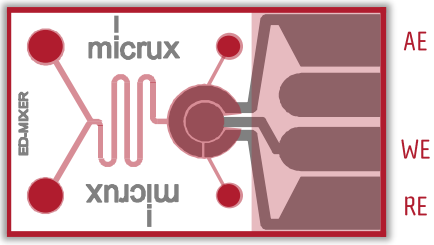
» Basic Microfluidic Single Sensors & Mixer Chips

A basic microfluidic stage can be integrated with a three-electrode system (working – WE, reference – RE, and auxiliary – AE electrode) in order to manage the sample load in the electrochemical cell. In the same way, a microfluidic mixing stage can be also integrated on-chip previously to the sensing area.

» Microfluidic Single-Sensor



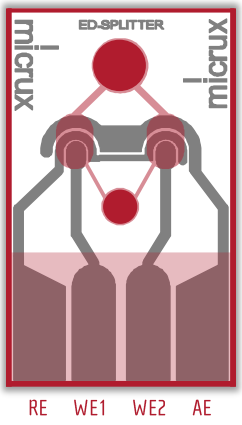
» Microfluidic Mixer Chip



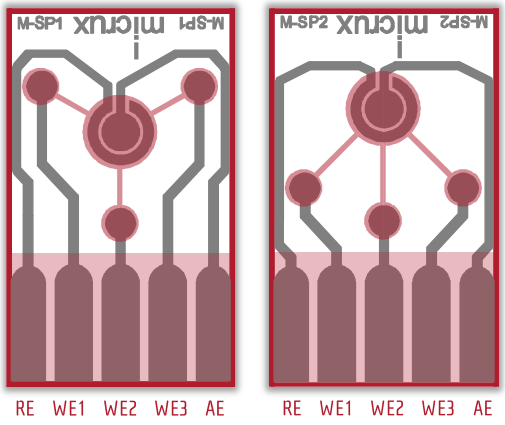
» Microfluidic Splitter Chips

A multiplexed detection can be accomplished on chip by integrating a microfluidic stage to split up the sample in several individual sensing points.

» Microfluidic Splitter Chip



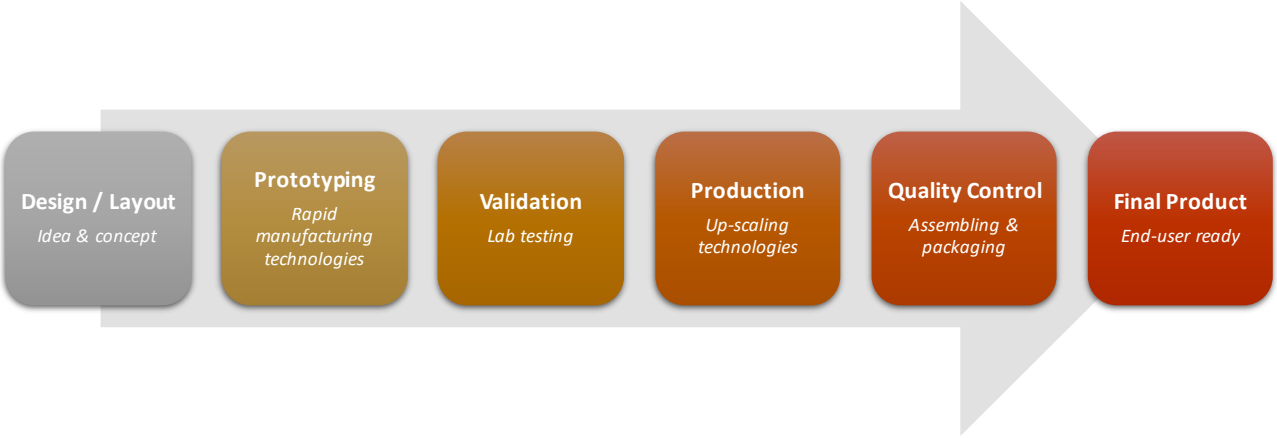
» Microfluidic Multi-Splitter Chips



more info

1.4. MICROFLUIDIC MANUFACTURING SERVICES

MicruX offers a wide support to customers in the development of their microfluidic parts with a very affordable cost. The development process chain is adapted to fulfill the requirements of customers. **MicruX** can take part in any phase for getting the best solution to customers.



1.4.1. Multilayer (3D) SU-8 mold on silicon wafers

Multilayer (3D) SU-8 master molds provide a cost-effective and useful tool for soft casting polymers (like PDMS) as well as hot-embossing processes.

SU8 microestructures can be manufactured on a Silicon wafer (4 inch) in order to get master molds with high precision and resolution (up to *5-µm* minimal features).

Up to two SU-8 layers *(3D microfluidics)* can be patterned with high aspect ratio (*1:1* typical) on silicon substrates:

Silicon wafer could be cut on smaller rectangular pieces in order to get individual masters. Other technical features can be fulfilled under request.

more info

1.5. ELECTROCHEMICAL & MICROFLUIDIC PLATFORMS

1.5.1. Drop-cell interface

The drop-cell connector (***Ref. ED-DROP-CELL***) provides a true user-friendly interface with the potentiostat, enabling the use of microvolume (1 – 10 µL sample drops) with all standard (10 x 6 mm) thin-film (micro)electrodes.

» **Dimensions:** 40 x 30 x 25 mm (WxDxH)

» **Material**: aluminium base + methacrylate cover

» **User friendly** (tool free assembly).

» **Easy** and **fast replacement** of the electrodes.

» **High quality** robust connector.

» **Reusable** – long-life.

The drop-cell connector and AIO-cell (***ref. ED-AIO-CELL***) are supplied with a universal cable compatible with any commercial potentiostat.

» Cable Terminals

miniUSB to Drop-cell / AIO-cell

2-mm Male or Female banana plug to potentiostat

Plug to potentiostat may be available in another format under previous request.

1.5.2. All-in-One Platform for thin-film electrodes

The innovative All-in-One cell (***ref. ED-AIO-CELL***) provides a unique multipurpose interface with movable add-ons that can be easily interchanged for using the standard (10 x 6 mm) thin-film (micro)electrodes.

» **Dimensions:** 60 x 40 x 30 mm (WxDxH)

» **Material**: aluminium base + methacrylate cover/add-ons

» **Easy** and **fast** electrode **replacement**.

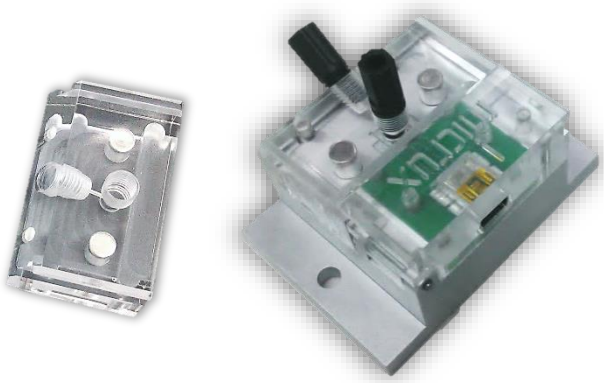
» Different **movable** Add-Ons.

» **Easy** Add-Ons **assembly** (tool free).

» **Reusable** – long life.

The AIO-cell enables the use of the thin-film (micro)electrodes in static *(Drop / Batch-cell)* or dynamic *(Flow-cell)* conditions, fulfilling the requirements of multiple analytical applications.

Movable Add-Ons



Flow-cell Add-ons

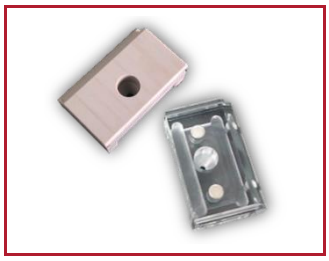
Batch-cell Add-ons

The AIO-cell is currently provided in two versions, the base cell + one add-on (***ref. ED-AIO-CELL-1x***) or the base cell + two add-ons (***ref. ED-AIO-CELL-2x***). Additional add-ons in **PMMA** (standard) or **PEEK** (on demand) can be provided with the base cell. The add-ons can be also supplied by separated and they can be customized *(materials / designs)* considering the specific requirements of the customers.

more info

Different Flow-cell and Batch-cell add-ons in **PMMA** (standard) and **PEEK** (on demand) are currently available for using in combination with the AIO platform and all standard (10 x 6 mm) thin-film (micro)electrodes.

» AIO add-ons



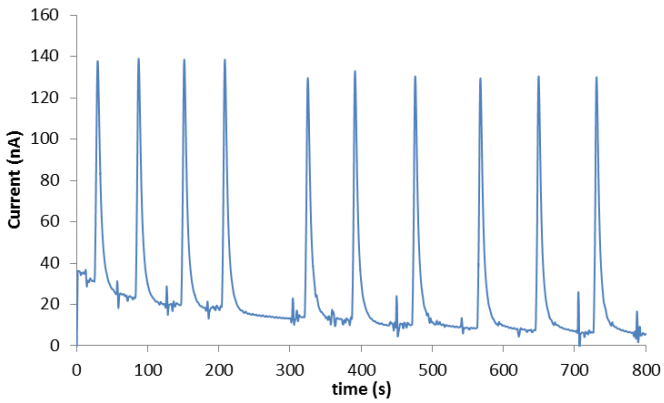
» Batch-cell Add-ons

- **BC-PMMA-5,0 / BC-PEEK-5,0.** Compatible with all thin-film (micro)electrodes and IDµElectrodes with 2- or 3,5-mm diameter electrochemical cell.
  The cell is sealed with a 5 mm I.D. O-ring.

» Flow-cell Add-ons

- **FC-PMMA-2,0 / FC-PEEK-2,0.** Compatible with thin-film (micro)electrodes with 2 mm diameter electrochemical cell. The cell is sealed with a 2 mm I.D. O-ring.
- **FC-PMMA-3,5 / FC-PEEK-3,5.** Compatible with thin-film IDµElectrodes with 3,5 mm diameter electrochemical cell. The cell is sealed with a 3,5 mm I.D. O-ring
- **TL-PMMA-1,0 / TL-PEEK-1,0.** Compatible with microfluidic electrochemical sensors. The inlet/outlet of the microfluidic channel is sealed with two 1,15 mm I.D. O-rings.

Amperometric measurements in a Flow Injection Analysis (FIA) system using the AIO cell with add-on FC-PMMA-2,0 and MicruX ECStat instrument (*ref. ECSTAT2020*).



Successive injections of $1 \cdot 10^{-5}$ M pAP in the FIA system using a thin-film Pt single-electrode (ED-SE1-Pt). Carrier: 0.1 M PBS, pH = 7.4, flow rate = 1 mL/min, E_d = +0.4 V. RSD = 4%, n = 10.

1.5.3. All-in-One SPE Platform for thick-film electrodes

A multipurpose All-in-One platform (***ref. ED-AIO-SPE-CELL***) with movable add-ons is also available for using the standard (27.5 x 10.1 mm) thick-film electrodes.

» **Dimensions:** 60 x 40 x 30 mm (WxDxH)

» **Material**: aluminium base + methacrylate add-ons

» **Easy** and **fast** electrode **replacement**.

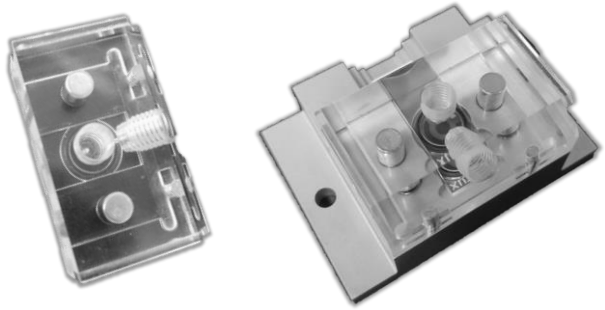
» Different **movable** Add-Ons.

» **Easy** Add-Ons **assembly** (tool free).

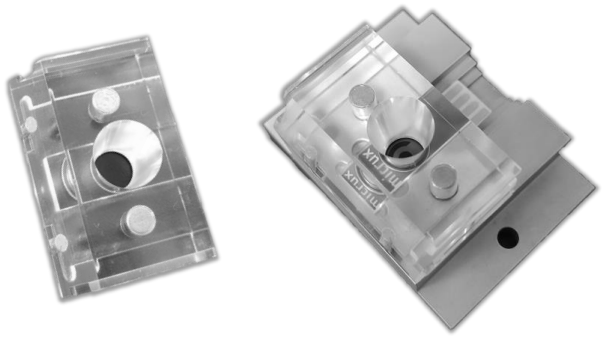
» **Reusable** – long life.

The **AIO-SPE-cel**l enables the use of the thick-film electrodes in static *(Batch-cell)* or dynamic *(Flow-cell)* conditions, fulfilling the requirements of multiple electroanalytical applications.

Movable Add-Ons



Flow-cell Add-on



Batch-cell Add-on

The **AIO-SPE-cell** is currently provided in two versions, the base cell + one add-on (***ref. ED-AIO-SPE-CELL-1x***) or the base cell + two add-ons (***ref. ED-AIO-SPE-CELL-2x***).

The **AIO-SPE-cell** is compatible with the ***SPE-CABLE connector*** *(**ref. ED-SPE-CABLE**)* for interfacing the electrodes with the potentiostat. This cable is supplied with the platform.

more info

1.5.4. Multi8x All-in-One Platform

The Multi8x All-in-One cell (***ref. ED-MULTI8x-AIO-CELL***) provides a **multiplexing** interface with movable add-ons that can be easily interchanged for using up to **eight** thin-film (micro)electrodes.

» **Dimensions:** 120 x 40 x 30 mm (WxDxH)

» **Material**: aluminium base + methacrylate cover/add-ons

» **Easy** and **fast** electrode **replacement**.

» Different **movable** Add-Ons.

» Add-Ons **assembly** by screws.

» **Reusable** – long shelf-life.

The multi8x AIO-cell enables the use of up to eight thin-film (micro)electrodes in static *(Drop / Batch-cell)* or dynamic *(Flow-cell)* conditions, providing a multiplexed detection system in several applications.

Movable Add-Ons

Multi-Flow-cell Add-ons

Multi- Batch-cell Add-ons

The Multi8x AIO-cell is currently provided in two versions, the base cell + one add-on (***ref. ED-MULTI8x-AIO-CELL-1x***) or the base cell + two add-ons (***ref. ED-MULTI8x-AIO-CELL-2x***). Additional add-ons in **PMMA** *(standard)* or **PEEK** *(on demand)* can be provided with the base cell. The add-ons can be also supplied by separated and they can be customized *(materials / designs)* considering the specific requirements of the customers.

Different Multi-flow-cell and Multi-batch-cell add-ons in **PMMA** *(standard)* and **PEEK** *(on demand)* are currently available for using in combination with the multi8x AIO platform and all standard (10 x 6 mm) thin-film (micro)electrodes.

» Multi8x AIO add-ons

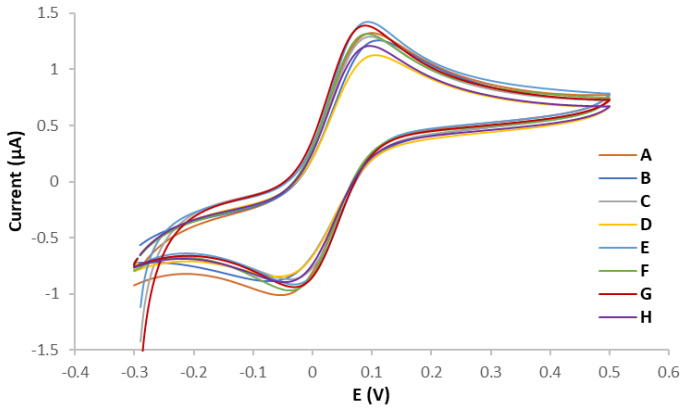
» Multi-batch-cell Add-ons

- **Multi8x-BC-PMMA-5,0 / Multi8x-BC-PEEK-5,0.** Compatible with thin-film (micro)electrodes with 2 mm or 3,5 mm diameter electrochemical cell. The cell is sealed with a 5 mm I.D. O-ring.
  The batch cell add-on features correspond to a column ***(A → H)*** *of a* ***96-well*** *microplate with up to 400 µL per well.*

» Multi-flow-cell Add-ons

- **Multi8x-FC-PMMA-2,0 / Multi8x-FC-PEEK-2,0.** Compatible with thin-film (micro)electrodes with 2 mm diameter electrochemical cell. The cell is sealed with a 2 mm I.D. O-ring.
- **Multi8x-FC-PMMA-3,5 / Multi8x-FC-PEEK-3,5.** Compatible with thin-film IDµElectrodes with 3,5 mm diameter electrochemical cell. The cell is sealed with a 3,5 mm I.D. O-ring
- **Multi8x-TL-PMMA-1,0 / Multi8x-TL-PEEK-1,0.** Compatible with microfluidic electrochemical sensors. The inlet/outlet of the microfluidic channel is sealed with two 1,15 mm I.D. O-rings.

Multi8x AIO platform enable the simultaneous or sequential employment of up to eight electrode chips in static *(see Figure)* or dynamic (flow-system) conditions by using a multi-potentiostatic station.



Simultaneous cyclic voltammograms for 1 mM $K_4Fe(CN)_6$ in 0.1 M KCl using eight ***(from A to H)*** *different thin-film Pt electrodes (ED-SE1-Pt) with the Multi8x AIO-cell. v = 50 mV/s, RSD < 5%.*

1.5.5. Multi-electrode Chip Platform

The multi-electrode chip platform (***Ref. ED-ME-CELL***) provides a simple and robust interface with a multi-potentiostat for using the thin-film multi-electrode chips developed by MicruX.

- *Multi-electrode platform (main unit)*

» **Dimensions:** 70 x 95 x 25 mm (WxDxH)

» **Material**: aluminium base + methacrylate covers

» **User friendly** (tool free assembly).

» **Easy** and **fast replacement** of the electrodes.

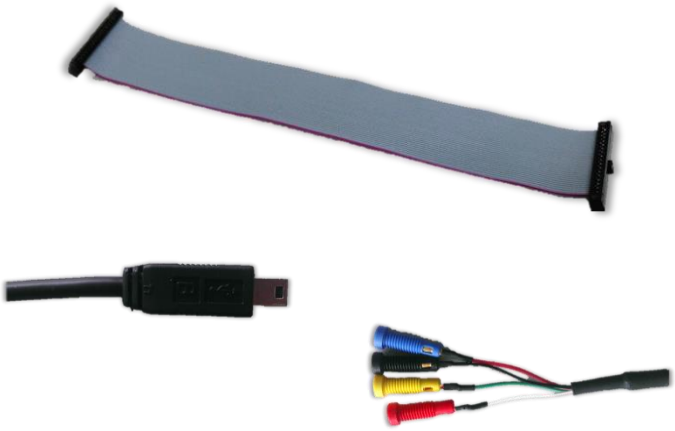
» **Reusable** – long -life.

» **Compatible** with up to 37x15 mm chips.

The multi-electrode platform consists of a main unit with chip accommodation and electronics, two interconnection boxes and universal cables for interfacing with any commercial multi-potentiostat. The platform enables up to *48 individual connections*. This cable interfacing is also provided with Multi8x AIO platform (***ref. ED-MULTI8x-AIO-CELL***).

- *Interconnection box*

- *Cables*

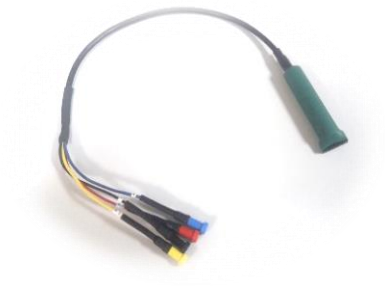


The platform enables the use of on-demand sensors, up to two 18.5x15 mm chips or one 37x15 mm chip. Tailored multi-electrode chips adapted to this platform can be manufactured with the specific requirements of the customers. The interface (connector box, cables…) for a specific multi-potentiostat can be also customized.

1.5.6. Other interfaces

MicruX provides additional connectors for easy interfacing the thick- and thin-film electrodes with the analytical instrumentation.

» CABLE connector for thick-film electrodes (ED-SPE-CABLE)



The SPE-CABLE connector ***(Ref. ED-SPE-CABLE)*** provides an interface between the thick-film electrodes (up to four contact pads) with the potentiostat, enabling the use of microvolume (20 – 50 µL sample drops) or dipping into a solution. The cable ends are available with 2-mm female or male bananas.

Dimensions: 50 cm long

» BOX connector for thick-film electrodes (ED-SPE-BOX)

The small BOX connector ***(Ref. ED-SPE-BOX)*** provides an interface between the thick-film electrodes (up to four contact pads) with any kind of potentiostat, enabling the use of microvolume (20 – 50 µL sample drops). The interface ends are available with 2-mm female bananas.

Dimensions: L58 x W40 x H15 mm

» CABLE connector for thin-film IDE electrodes (ED-IDE-CABLE)

The IDE-CABLE connector ***(Ref. ED-IDE-CABLE)*** provides an interface between the thin-film IDµElectrodes (IDE - two contact pads) with the potentiostat, enabling the use of microvolume (2 – 10 µL sample drops) or dipping into a solution. The cable ends are available with 2-mm female or male bananas.

Dimensions: 50 cm long

Other interfaces may be requested for adapting the thick- and thin-film electrodes in a specific experimental set-up.

1.5.7. External Electrodes Platform

The EEP Platform (***ref. EEP-AIO-CELL***) enables the use of external electrodes in the AIO-cell in static conditions with the batch-cell add-ons. The EEP Platform simplify the placement of the external electrodes in the AIO-cell to be used with the *MicruX' thick- & thin-film electrodes*.

» **Dimensions:** 75 x 65 x 35 mm (WxDxH)

» **Material**: PLA

» **Easy** AIO-cell fitting.

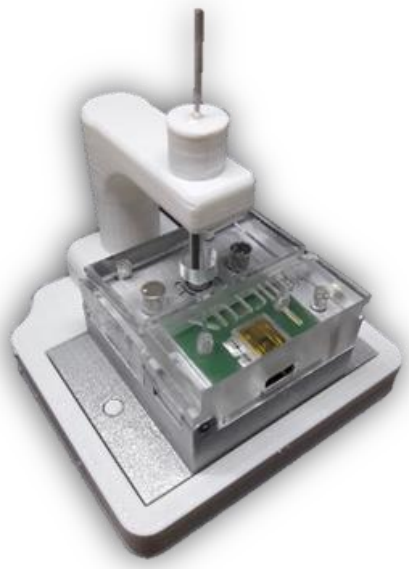
» Different **Arms** for the placement of external electrodes.

» **Easy** and **Fast** arm positioning.

» **External electrodes** are always placed in the same position

The EEP Platform can be used to place just the *external reference electrode* or the *reference and auxiliary electrodes* together.

Platform with external reference electrode



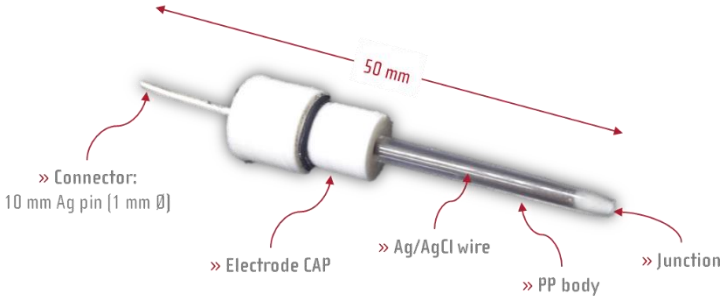
Platform with external reference & auxiliary electrodes

The platform is compatible with the external miniaturized electrodes *(reference & auxiliary electrodes)* provided by MicruX.

MicruX provides miniaturized reference *(Ag/AgCl)* and auxiliary/counter *(Pt or SS)* electrodes for using with MicruX' thick- / thin-film (micro)electrodes and EEP-AIO platform. External electrodes *(reference and auxiliary/counter electrodes)* can be a useful solution in several electroanalytical applications.

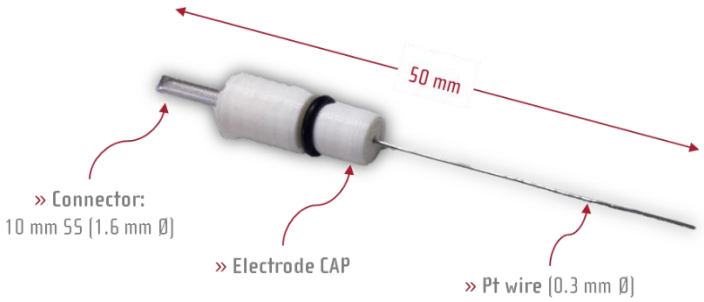
» Reference Electrode – Ag/AgCl

Miniaturized reference electrode consists of a silver/silver chloride (Ag/AgCl) wire inserted in a polypropylene (PP) body with 3M KCl as supporting electrolyte (***Ref. RE-Ag/AgCl***).



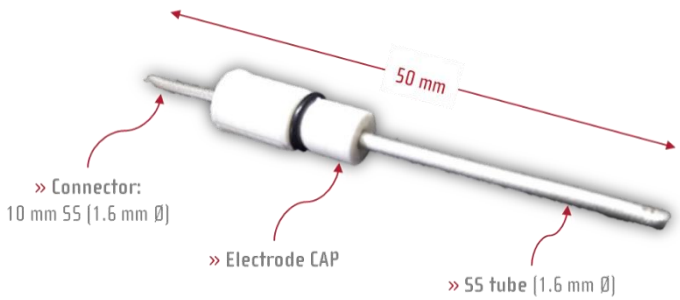
» Auxiliary/Counter Electrode – Pt

Auxiliary/counter electrodes are made of a highly inert material. Thus, MicruX provides Platinum Auxiliary/Counter electrodes (***Ref. CE-Pt***).



» Auxiliary/Counter Electrode – SS

Auxiliary/counter electrodes can be made of other inexpensive materials. Thus, MicruX also provides Stainless Steel (SS) Auxiliary/Counter electrodes (***Ref. CE-SS***).



1.6. INSTRUMENTATION

MicruX provides portable analytical instruments that can be used with thick- & thin-film electrodes as well as any classical electrodes.

1.6.1. Miniaturized Electrochemical Workstation

» MicruX® ECStat

MicruX ECStat (***ref. ECSTAT2020)*** is a USB-powered *All-in-One Electrochemical Workstation*, including a Bipotentiostat / Galvonostat with built-in Impedance Analyzer, in a very compact and portable equipment.

» **Dimensions**: 160 x 100 x 45 mm (L x W x H)

» **USB**-powered

» Control PC software - **MicruX EC Manager**

» **Interfacing:** USB-C

» **LED indicators:** power on, cell on

» Built-in **FRA/EIS analyzer**: 10 µHz to 1 MHz

» **Current ranges:** 100 pA to 10 mA (max. current: ± 30 mA)

» **Operating modes:** bipotentiostat, potentiostat, ZRA, galvanostat, Potentiostatic-EIS analyzer

» MicruX® ECStat – Standard Pack

Basic content:

» Bipotenciostat/Galvanostat/Impedance Analyzer

» Plastic briefcase

» Sensor cable with 2-mm banana plugs (+ Alligator clips)

» USB-C cable

» Y-USB cable (for BIPOT extra power)

» Dummy cell

» MicruX® EC Manager software

Additional accessories:

» Sensor cable with miniUSB plug for MicruX platforms

» Electrode Pack (30 thin-film electrodes + drop-cell interface)

» MicruX® ECStat features

General	
» DC-potential range	± 10 V
» Compliance voltage	± 10 V
» Maximum current	± 30 mA
Potentiostat	
» Applied DC-potential resolution	75 µV
» Applied potential accuracy	≤ 0.1% ± 1 mV offset
» Current ranges	100 pA to 10 mA (9 ranges)
» Current accuracy	≤ 0.1 % (at Full Scale Range)
» Measured current resolution	0.006 % of current range (5 fA on 100 pA range)
Galvanostat	
» Current ranges	1 nA to 10 mA (8 ranges)
» Applied DC-current range	± 6 times applied current range
» Applied DC-current resolution	0.005 % of applied current range
» Measured DC-potential accuracy	75 µV at ± 10 V 7.5 µV at ± 1 V 0.75 µV at ± 0.1 V
EIS (impedance measurements)	
» Frequency range	10 µHz to 1 MHz
» AC-amplitude range	1 mV to 250 mV rms, or 0.6 V p-p
Electrometer	
» Electrometer amplifier input	> 1 TΩ // 10 pF
» Bandwidth	1 MHz
Other	
» External inputs/outputs (D-Sub 15)	Iout, Eout 1 Analog input (± 10V, 18 bit) 1 Analog output (0-10 V, 12 bit, 1 kOhm output impedance) 4 Digital outputs (5 V) 1 Digital input (5 V)
» Housing	Aluminum case: 160 x 100 x 45 mm^3
» Weight	0,5 Kg
» Temperature range	0 °C to + 50 °C
» Power supply	USB power supply
» Communication	USB-C

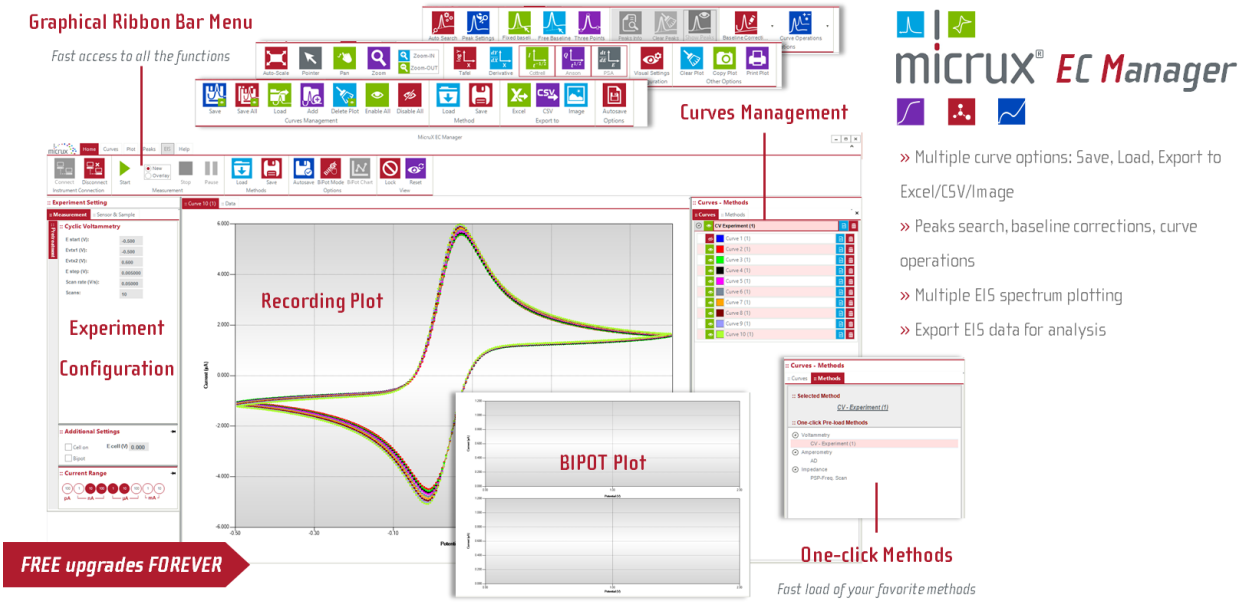
» MicruX® ECStat – Available Techniques

Voltammetry	
CV	Cyclic Voltammetry
FSCV	Fast-Scan Cyclic Voltammetry
LSV	Linear Sweep Voltammetry
DPV	Differential Pulse Voltammetry
NPV	Normal Pulse Voltammetry
SWV	Square Wave Voltammetry
ACV	Alternating Current Voltammetry
Amperometry	
AD	Single-Potential DC Amperometry
FA	Fast Amperometry
PAD	Pulsed Amperometric Detection
DPA	Differential Pulse Amperometry
MSA	Multi-Step Amperometry

Potenciometry	
ZCP	Zero Current Potentiometry
PD	Potentiometric Detection
MSP	Multi-Step Potentiometry
PSA	Potentiometric Stripping Analysis
Impedance (Potentiostatic Mode)	
PFP	PEIS – Fixed Potential
PSP	PEIS – Scan Potential
PTS	PEIS – Time Scan
Bipotentiostat	
CV-CV* // CV-AD*	
LSV-LSV* // LSV-AD*	
AD-AD* // MSA-MSA* // MSA-AD*	
**WE2 potential is fixed or offset from WE1 potential*	

» MicruX® EC Manager

MicruX® EC Manager provides a modern *graphical user interface* for the control of the instrument from a PC, enabling real-time plotting as well as storage and analysis of the results.



1.6.2. Ultra-compact Electrochemical Sensing Interface

» MicruX® ECSens

MicruX ECSens (***ref. ECSENS100)*** is the most compact and affordable *Electrochemical Sensing Interface*, integrating a miniature potentiostat, specially designed for using printed electrodes and other sensors.

» **Dimensions**: 36 x 15 x 8 mm (L x W x H)

» **USB**-powered

» Control PC software - **MicruX EC Manager Lite**

» **Interfacing:** USB-C

» **LED indicators:** power on / cell on

» **Potential range**: ±1.08 V

» **Current ranges:** 6.5 µA to 0.75 mA (max. current: ± 0.75 mA)

» **Operating modes:** potentiostat (multi-channel mode available)

» MicruX® ECSens – Available Techniques

Voltammetry	
CV	Cyclic Voltammetry
LSV	Linear Sweep Voltammetry
DPV	Differential Pulse Voltammetry
NPV	Normal Pulse Voltammetry
SWV	Square Wave Voltammetry

Amperometry	
AD	Amperometry (Single-potential)
CA	Chronoamperometry (Multi-step)

» MicruX® ECSens – Standard Pack

Basic content:

» ECSens ultra-compact potentiostat

» Sensor interface for MicruX screen-printed electrodes (S1PE)

» Electrode Pack (50 units ED-S1PE-C)

» USB adaptor (USB-C Female to USB-A male)

» USB extension cable

» Dummy cell

» MicruX® EC Manager software Lite

» MicruX® ECSens features

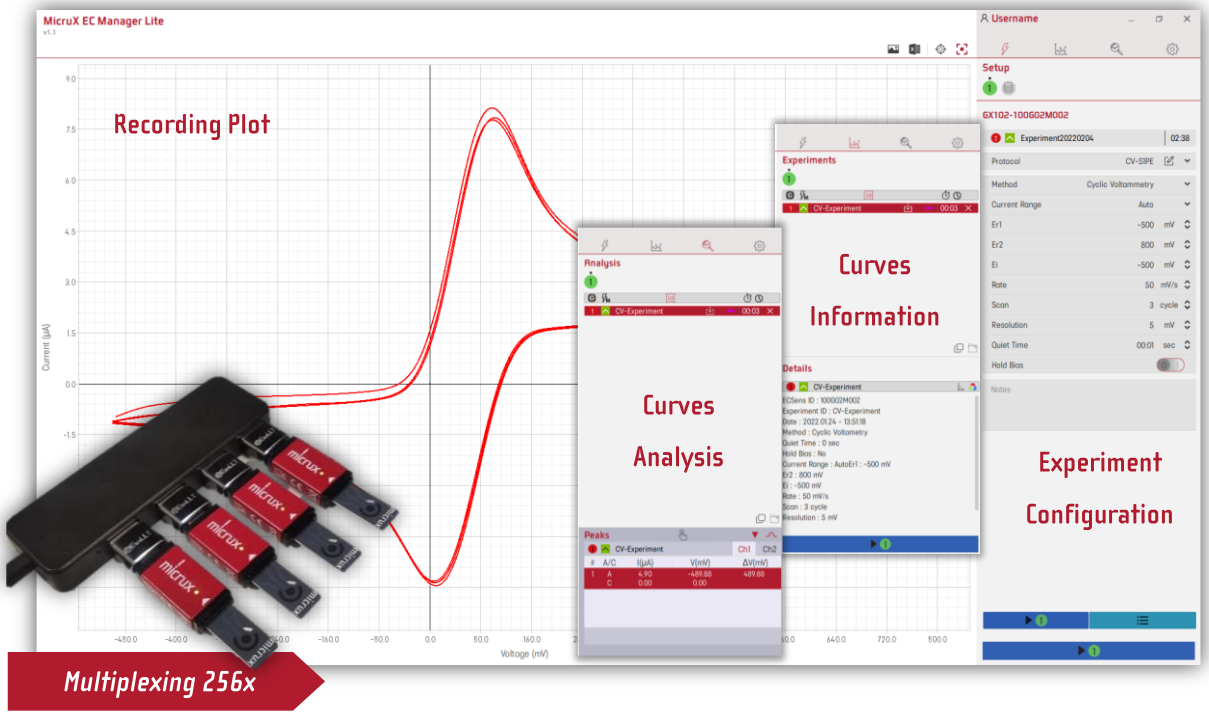
General	
» DC-potential range	± 1.08 V
» Compliance voltage	± 2 V
» Maximum current	± 0.75 mA
Potentiostat	
» Applied DC-potential resolution	250 µV
» Applied potential accuracy	≤ 0.1%
» Current ranges	6.5 µA to 0.75 mA (7 ranges)
» Current accuracy	≤ 0.1 % (at Full Scale Range)
» Measured current resolution	0.002 % of current range (130 pA on 6.5 µA range)
Multi-channel mode	
» Multiplexing	Up to 256 devices (PC software control)
Other	
» Housing	Aluminum case: 36 x 15 x 8 mm^3
» Weight	< 5 g
» Power supply	USB (5 VDC / 20 mA max.)
» Communication	USB-C

» MicruX® EC Manager LITE

MicruX® EC Manager Lite is the basic graphical user interface for the control of the device from a PC, enabling real-time plotting, storage and analysis of the results.

The software also enables control of multiple devices from same screen and at the same time, setting up parallel replicates and spools for multiplexing analysis.

MicruX® ECSens and EC Manager Lite provide a first-class entry-level ultra-compact potentiostat for electrochemical studies, development of biosensors and many other applications. A powerful interface with many possibilities.



» Multiple curve options: Load, Overlay, Export to Excel/Image.

» Experiment spooling: set up sequential multi-experiments.

» Multi-channel option: *multiplexing* control up to 256 devices.

» Curves analysis / Peaks search.

MULTIPLEXING CAPABILITY

micrux EC Manager LITE

Smart Microfluidic & Electrochemical Solutions for Research Science

2. ACCESSORIES FOR MICROFLUIDICS & ELECTROCHEMISTRY

MicruX provides several additional accessories necessaries to suitable work with microfluidic devices, electrochemical sensors and portable analytical instrumentation.

2.1. PUMPING SYSTEMS

Different pumping systems are available for the use of microfluidic and electrochemical solutions provided by MicruX or any other supplier.

2.1.1. Multi-channel LP Peristaltic Tube Pump

Peristaltic pumps offer a *low-cost* solution with an *excellent performance* for most lab applications.

References	BT100-3J	BT100-1F	BT100-1L
Peristaltic pump specifications			
» Channels (DG Series):	1-2	1-4	4-24
» Flow rate range:	0.000166 to 32 mL/min		0.002 mL/min to 32 mL/min
» Speed range:	0.1 -100 rpm, CW/CCW		
» Speed resolution:	0.1 rpm		
» Work Mode:	--	Flow rate and dispensing mode	--
» Display:	3-digit LED display for current speed. 3 LED indicators for operating state	LCD for running state	128 × 64 graphic LCD for current running status
» Control mode:	Membrane keypad, external signal and communication control	Control panel, external signal and communication control	
» External control:	Start/stop, direction and speed control (4-20mA, 0-5V, 0-10V, 0-10kHz external control module optional)		
» Comm. Interface:	RS485		
» Power-off memory:	Return to previous state when power on		
» Prime:	Fast filling or emptying at full speed		
» Power supply:	AC 90V-260V		AC 220 V ± 10% 50/60 Hz (standard) or AC 110 V ± 10% 50/60 Hz (optional)
» Dimensions (L x W x H):	232 x 142 x 149 mm	285 x 207 x 180 mm	202 × 160 × 239 mm
» Weight:	2.3 Kg	3.8 Kg	5.3 Kg
» Power consumption:	30W	40W	50W
» Operating temperature:	0 to 40 ºC		
» Relative humidity:	< 80%		
» IP rate:	IP31		

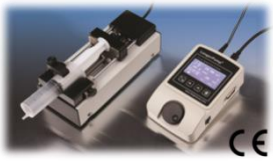
References	L100-1E	L100-1S	L100-1F
Peristaltic pump specifications			
» **Channels (DG Series):**	1-2	1-4	
» **Flow rate range:**	0.000166 to 32 mL/min	0.15 µL/min to 32 mL/min	
» **Speed range:**	0.1 -100 rpm, CW/CCW	0.01 -100 rpm, CW/CCW	0.1 -100 rpm, CW/CCW
» **Speed resolution:**	0.1 rpm	0.01 rpm	0.1 rpm
» **Work Mode:**	--	Speed control and flow rate mode	Programming
» **Display:**	3-digit LED display for current speed. 2 LED indicators for running direction	LCD	7” 1024*600 color LCD
» **Control mode:**	Membrane keypad control	Membrane keypad, external signal and communication control	Touch screen control, footswitch control, external signal control and communication control
» **External control:**	--	Start/stop, direction and speed control (4-20mA, 0-5V, 0-10V, 0-10kHz external control module optional)	Start/stop control, direction control: voltage level signal or switch signal (dry contact)
» **Communication interface:**	--	RS485. Longer or Modbus protocol	USB or RS485(RJ11). Modbus protocol
» **Power-off memory:**	Return to previous state when power on	Operating parameters will be saved automatically	Pump can start running at desired time
» **Prime:**	Fast filling or emptying at full speed		
» **Power supply:**	AC 100-240V, 50/60Hz		AC 220V ± 20% / AC 110V ± 20%, 50Hz/60Hz
» **Dimensions (L x W x H):**	197 x 110 x 91 mm	232 x 142 x 149 mm	180 x 292 x 235 mm
» **Weight:**	2.3 Kg	2.38 Kg	5.0 Kg
» **Power consumption:**	15W	25W	50W
» **Operating temperature:**	0 to 40 ºC		
» **Relative humidity:**	< 80%		
» **IP rate:**	IP31		

Other options (with different channels, precision, flow rate…) are available on demand depending on the specific requirements.

more info

2.1.2. Single & Dual Syringe Pumps LP series

Syringe pumps LP offer a suitable solution for high accuracy and small flow rate liquid transferring.

References	LSP01-3A	LSP01-2A	TJ-3A / W0109-1B	LSP02-2B
Syringe pump specifications				
» Working Mode:	Infusion		Infusion, withdrawal, infusion/withdrawal, withdrawal/infusion, continuous	
» Channels:	1			2
» Pump stroke:	140 mm		90 mm	140 mm
» Advance per microstep:	0.156 µm	0.031 µm	0.165 µm	0.156 µm
» Max. linear rate:	65 mm/min	13 mm/min	79.4 mm/min	130 mm/min
» Min. linear rate:	5 µm/min	1 µm/min	7.94 µm/min	5 µm/min
» Linear force:	> 90 N			> 180 N
» Accuracy:	≤ ± 0.5% error in the condition of > 30% of max. infusion distance			
» Flow rate:	0.83 nL/min – 54.2 mL/min	0.16 nL/min – 10.8 mL/min	0.139 µL/min – 52.9 mL/min	0.83 nL/min – 150.5 mL/min
» Syringe size:	10 µL – 60 mL		1 – 60 mL	10 µL – 140 mL
» Display setting:	Display volume, flow rate or linear speed (128x64 graphic LCD)			
» Power-off memory:	Storing the running parameters automatically			
» State signal output:	2 output signals (OC gate signal) to indicate start/stop and direction			
» Control signal input:	Falling edge or TLL signal to control start/stop			
» Comm. interface:	RS485			
» Power supply:	AC 90V-260V / 15W		AC 90V-260V / 10W	AC 90V-260V / 20W
» Operating temperature:	0 to 40 ºC			
» Relative humidity:	< 80%			
» Dimensions (D X W X H):	280 x 210 x 140 mm		170 x 108 x 70 mm / 245 x 100x 95 mm *(controller / drive unit)*	280 x 250 x 140 mm
» Weight:	3.6 Kg		0.8 Kg *(controller)* 1.3 Kg *(drive unit)*	4.3 Kg

Other options (with different channels, precision, flow rate…) are available on demand depending on the specific requirements.

more info

References	dLSP510	dLSP520	dLSP510 Pro	dLSP520 Pro
Syringe pump specifications				
» Working Mode:	Infusion, withdrawal, infusion/withdrawal, withdrawal/ infusion, auto repeated, programming (on dedicated PC software)			
» Channels:	1	2	1	2
» Advance per microstep:	0.03255 µm/µstep		0.015625 µm/µstep	
» Linear speed:	0.0833 µm/min – 180 mm/min		0.04 µm/min - 86.4 mm/min	
» Step speed:	23.4375 sec/µstep - 10.85 µsec/µstep			
» Flow rate:	0.0007 nL/min – 120.044 mL/min		0.0003 nL/min – 57.621 mL/min	
» Linear travel accuracy	± 0.5%		± 0.35%	
» Linear travel CV:	± 0.05%			
» Linear force:	40lbs/18kg @ l00% force selection			
» Motor and drive:	1.8º step motor with 1/64 microstepping			
» Syringe size:	0.5 µL – 60 mL	0.5 µL – 30 mL	0.5 µL – 60 mL	0.5 µL – 30 mL
» Display:	7inch, 1024x600, IPS HD LCD			
» Control mode:	Touch screen control, dedicated PC or Android App control, footswitch control, RS485 communication control			
» Calibration:	Improve flow rate/ dispensing volume precision and accuracy			
» Voice reminder:	N/A		For working progress, alarm, diagnosis	
» Intelligent diagnosis:	N/A		For presence of syringes, syringe leakage	
» Screen lock:	To prevent misoperation			
» Electronic signature:	N/A		Meet the requirement of 21CFR Part 11	
» Support 3Q (IQ/OQ/PQ):	Meet GMP requirement			
» EMC:	CE (TUV) certified			
» Dimensions (D X W X H):	Drive unit: 260mm x185mm x l80mm, Controller: 190mm x123mm x 33mm			
» Power supply:	AC 100V-240V/30W 50/60Hz		AC 100V-240V/20W 50/60Hz	
» Operating condition	Temperature: 5ºC - 40ºC, Relative humidity<85%			
» IP rating:	IP31			
» Weight:	Drive unit: 3.49kg, Controller: 0.37kg			

Other options (with different channels, precision, flow rate…) are available on demand depending on the specific requirements.

more info

2.1.3. Single & Multi Syringe Pumps NE series

Syringe pumps NE provide a very affordable solution for fluids handling in multiple applications.

References	NE-300	NE-1000	NE-4000	NE-1600/1800/1200
Syringe pump specifications				
» **Working Mode:**	Infusion	infusion/withdrawal		
» **Channels:**	1		2	Up to 12
» **Motor type:**	Step motor			
» **Motor step *per* resolution:**	400		200	
» **Microstepping:**	1/8 to 1/2 depending on motor speed			
» **Advance per step:**	0.2126 µm to 0.8504 µm depending on motor speed		0.4252 µm to 1.7009 µm depending on motor speed	0.1323 µm to 0.5292 µm depending on motor speed
» **Maximum speed:**	38 mm/min	51 mm/min	184 mm/min	35 mm/min
» **Minimum speed:**	0.7 µm/min		1.3 µm/min	0.4 µm/min
» **Linear force:**	> 150 N at minimum speed, 80 N at maximum speed		> 400 N at minimum speed, 80 N at maximum speed	> 700 N at minimum speed, 130 N at maximum speed
» **Accuracy:**	Within +/- 1% over length of syringe, exclusive of syringe variations			
» **Flow rate:**	12 nL/min – 20 mL/min	12 nL/min – 30 mL/min	25 µL/min – 100 mL/min	8 nL/min – 20 mL/min
» **Syringe size:**	1 – 60 mL (140 mL partially filled)			0.5 µL – 140 mL
» **Number of program phases:**	--	41		
» **Comm. interface:**	--	RS-232 (network up to100 pumps)		
» **Power supply:**	Unregulated linear external wall adapter, country and power source specific (or compatible regulated power supply)			
» **Dimensions (D X W X H):**	229 x 146 x 114 mm			260 x 381 x 127 mm
» **Weight:**	1.63 Kg			4.6 Kg

Other options (with different channels, precision, flow rate…) are available on demand depending on the specific requirements.

Accessories, such as syringes, cables, control software, etc…, are also available.

Note: *Specifications subject to change without prior notice. Not for Clinical Use on Humans.*

more info

2.1.4. Microfluidic & High-pressure Syringe Pumps NE series

Syringe pumps NE series also offer solutions for microfluidic and high-pressure applications.

References	NE-1002X	NE-4002X	NE-8000
Syringe pump specifications			
» Working Mode:	Infusion / withdrawal		
» Channels:	1	2	1
» Motor type:	Step motor		
» Motor step *per* resolution:	400	200	
» Microstepping:	1/16 to 1/2 depending on motor speed	1/8 to 1/2 depending on motor speed	1/8 to 1/1 depending on motor speed
» Advance per step:	4.2522 nm to 34.0179 nm depending on motor speed	0.4252 µm to 1.7009 µm depending on motor speed	0.5051 µm to 4.0409 µm depending on motor speed
» Maximum speed:	2.245 mm/min	183.369 mm/min	300.33 mm/min
» Minimum speed:	0.014 µm/min	1.402 µm/min	1.665 µm/min
» Linear force:	> 650 N at minimum speed, 80 N at maximum speed	> 400 N at minimum speed, 80 N at maximum speed	> 850 N at minimum speed, 445 N at maximum speed
» Accuracy:	Within +/- 1% over length of syringe, exclusive of syringe variations		
» Flow rate:	0.008 nL/h – 1246 µL/min	0.008 nL/h – 1555 µL/min	1.726 µL/h – 247.4 mL/min
» Syringe size:	0.5 µL – 60 mL (140 mL partially filled)		0.5 µL – 140 mL (200 mL partially filled)
» Number of program phases:	41		
» Comm. interface:	RS-232 (network up to100 pumps)		
» Power supply:	Unregulated linear external wall adapter, country and power source specific (or compatible regulated power supply)		
» Dimensions (D X W X H):	229 x 146 x 114 mm		286 x 156 x 162 mm
» Weight:	1.63 Kg		3.55 Kg

Other options (with different channels, precision, flow rate…) are available on demand depending on the specific requirements.

Accessories, such as syringes, cables, control software, etc…, are also available.

Note: *Specifications subject to change without prior notice. Not for Clinical Use on Humans.*

more info

2.2. FLOW SYSTEM PACKS

MicruX provides different accessories usually required for using the standard thin/thick-film (micro)electrodes in flowing liquids systems. Thus, MicruX has available different packs of accessories for using thin/thick-film electrodes in flow system with the All-in-One platform *(Flow-cell add-on)*.

2.2.1. Basic fitting pack *(Ref. B-PACK)*

Part reference		Items	Amount
	*008NF16-2100*	Fitting nuts (1/4" - 28 UNF - 1/16" OD tubing)	1 pk (5 units)
	*008FT16-2310*	Ferrules PTFE/SS (1/4" - 28 UNF - 1/16" OD tubing)	1 pk (5 units)
	*008T16-080-1*	PTFE tubing (OD: 1,6mm - 1/16" - ID: 0,8 mm)	1 m
	*LSPS10*	Luer-slip plastic syringes (10 mL)	5 units
	*DS001*	Disposable scalpel	1 unit

2.2.2. Basic-Plus pack *(Ref. B-PACK+)*

Part reference		Items	Amount
	*008NF16-2100*	Fitting nuts (1/4" - 28 UNF - 1/16" OD tubing)	1 pk (5 units)
	*008FT16-2310*	Ferrules PTFE/SS (1/4" - 28 UNF - 1/16" OD tubing)	1 pk (5 units)
	*008T16-080-1*	PTFE tubing (OD: 1,6mm - 1/16" - ID: 0,8 mm)	1 m
	*GL32*	Glass reservoir (GL32 thread - 50 mL)	2 units
	*0032T-2*	Bottle cap (GL32 thread/ 2 x Luer ports)	2 units
	*LSPS10*	Luer-slip plastic syringes (10 mL)	5 units
	*DS001*	Disposable scalpel	1 unit

2.2.3. Full system pack *(Ref. F-PACK)*

Part reference		Items	Amount
	*ED-AIO-CELL-1x*	AIO platform (Drop + Flow-cell add-on)	1 unit
	*ED-TF-Electrodes*	Standard thin-film microelectrodes	25 units
	*LP-L100-1E/DG-2(10)*	Peristaltic Tube Pump (two channels)	1 unit
	*38-0XXX*	Standard peristaltic tubes (two different diameters)	10 units
	*7010 / 7012*	Injection valve (20 µL loop) with loop fill port	1 unit
	*008NF16-2100*	Fitting nuts (1/4" - 28 UNF - 1/16" OD tubing)	1 pk (5 units)
	*008FT16-2310*	Ferrules PTFE/SS (1/4" - 28 UNF - 1/16" OD tubing)	1 pk (5 units)
	*008T16-080-1*	PTFE tubing (OD: 1,6mm - 1/16" - ID: 0,8 mm)	1 m
	*GL32*	Glass reservoir (GL32 thread - 50 mL)	2 units
	*0032T-2*	Bottle cap (GL32 thread/ 2 x Luer ports)	2 units
	*LSPS10*	Luer-slip plastic syringes (10 mL)	5 units
	*DS001*	Disposable scalpel	1 unit
	*TW001*	Tweezers	1 unit
	*SP001*	Mounting brackets / panels	1 set

Other pack options; with different peristaltic or syringe pumps, additional accessories…, are also available on demand. Packs might be customized taking into account the specific requirements of customers.

more info

2.3. DIGITAL MICROSCOPE

The Standalone Desktop LCD Digital Microscope ***(ref. SDM-1200x-LCD)*** provides a great complement for a wide range of applications including inspection of electronics, microfluidic channels, electrodes, etc…

TECHNICAL FEATURES

» **Image Sensor:**	5 MegaPixel (up to 12M by interpolation)
» **Controller:**	High Speed DSP
» **Flicker Rate:**	50Hz/60Hz
» **Focus Range:**	Manual Focus From 10mm to 50mm
» **Light Source:**	8 LEDS with Adjustable Brightness
» **Digital Magnification:**	Up to 1200x
» **Optical Magnification:**	10x to 300x
» **Battery:**	Rechargeable 3.7V/1050 mAh Li-ion Battery
» **Working Time:**	2 hours
» **Charge Time:**	3 hours
» **Video Format:**	AVI
» **Video Resolution:**	VGA, QVGA - 30 fps
» **LCD Screen:**	3.5” LCD screen, 4:3 ratio, resolution 320x240 pixels
» **OSD Languages:**	English, German, French, Spanish, Russian, Italian, Portuguese, Dutch, Polish, Japanese, Korean, Chinese
» **microSD Card:**	Up to 32GB microSDHC
» **TV Output:**	Available (to any monitor with TV in)
» **Dimensions:**	22.9 x 15.2 x 15.2 cm
» **Weight:**	0.9 Kg

The Digital Microscope operates completely standalone or compatible with PC, Mac and iPad (using iPad camera kit for image import). Up to 1200x magnified and LED illuminated viewing, snapshot, filming and measurement calibration functions.

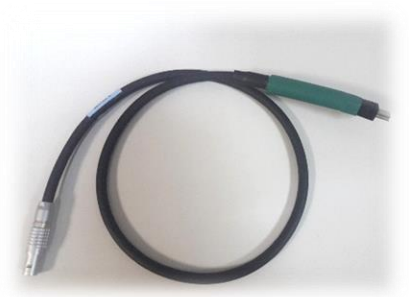
» Package Contents

- » Digital Microscope
- » Quick Start Guide
- » Software CD
- » Battery
- » USB cable
- » TV cable
- » Calibration chart
- » Cleaning fabric
- » microSD card

2.4. OTHER ACCESSORIES

MicruX provides any additional complementary tools necessaries to suitable work with microfluidic devices, electrochemical sensors and portable analytical instrumentation.

» Bipotentiostat cable – miniUSB plug



» Ref. ECSTAT-USB

Bipotentiostat cable with miniUSB plug for using in combination with *MicruX® ECStat* to directly connect the MicruX' electrochemical platforms with thin-film electrodes.

Cable dimensions: 50 cm long

» Bipotentiostat cable – Banana plug

» Ref. ECSTAT-CAB2M

Bipotentiostat cable with 2-mm male banana plug (+ alligator clips) for using in combination with *MicruX® ECStat* to connect the electrodes of detection system.

Cable dimensions: 100 cm long

micrux
TECHNOLOGIES

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