Electrochemical Green Engineering Group

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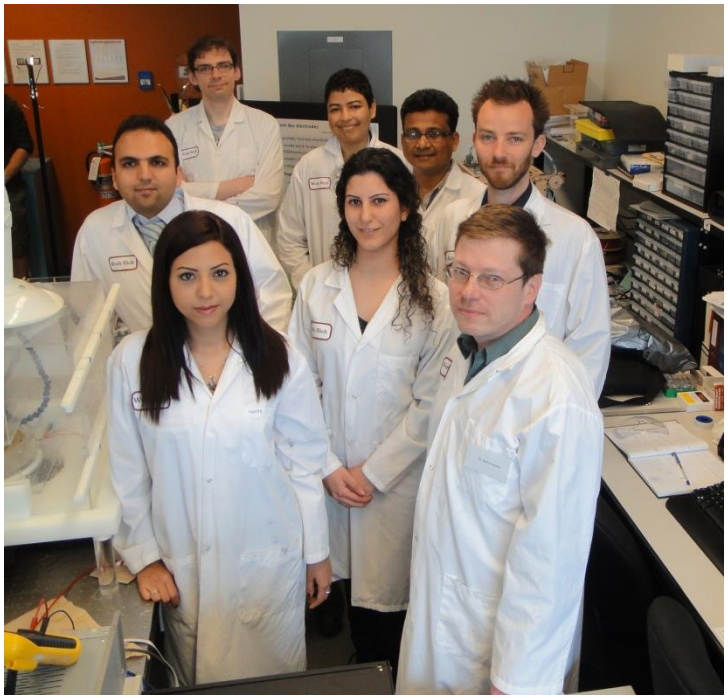
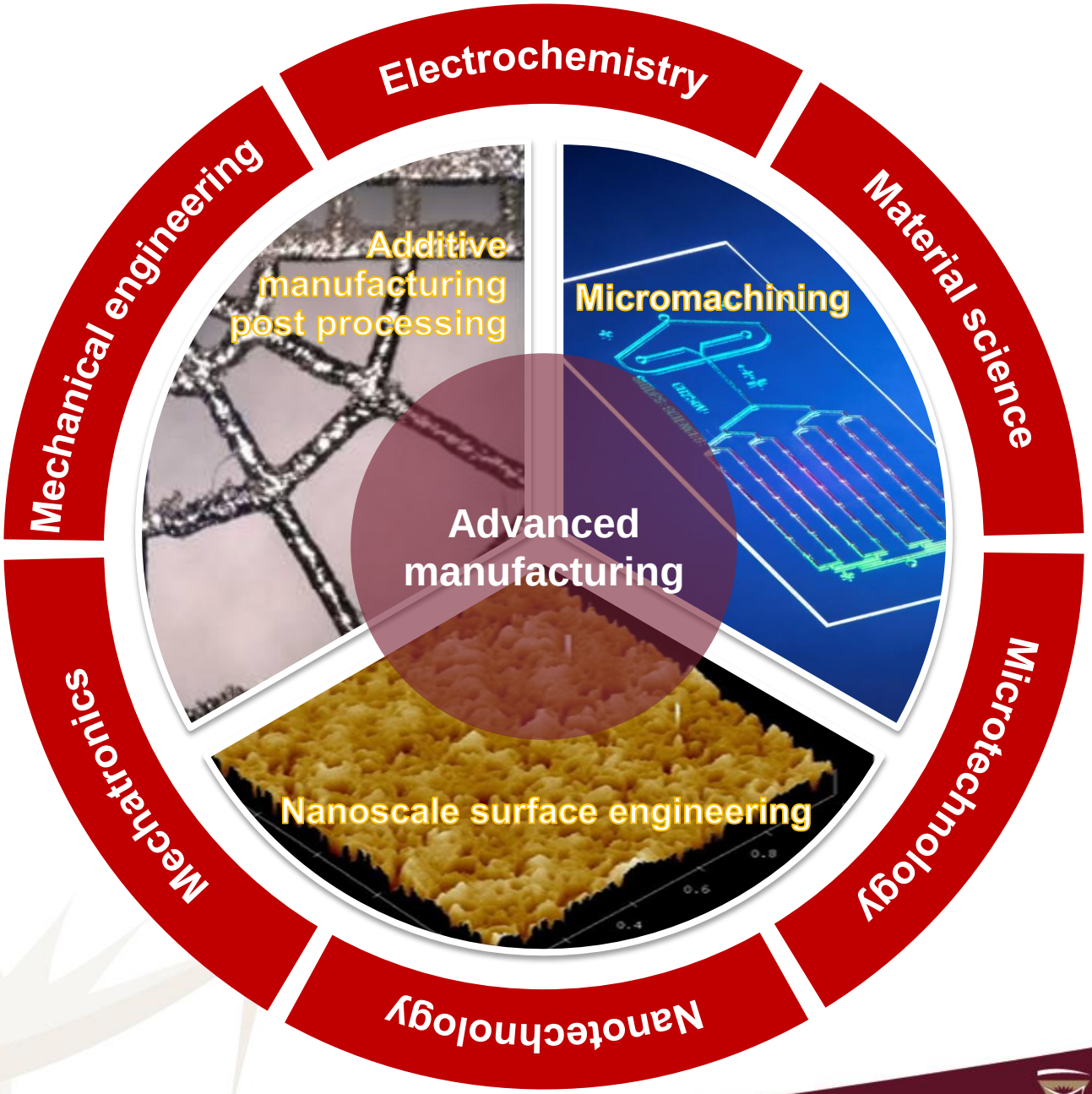
Department of Mechanical and Industrial Engineering

Concordia University

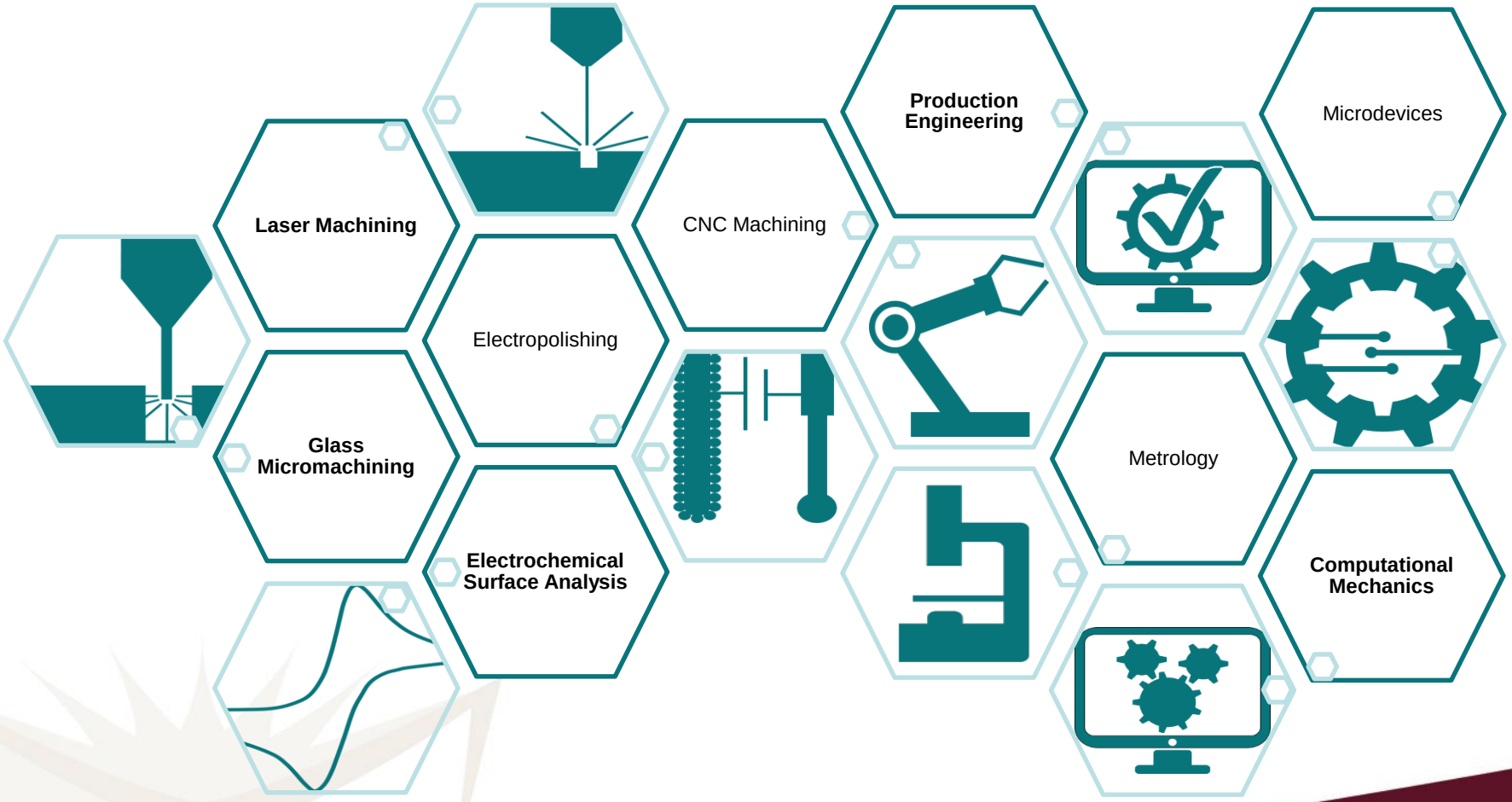
Our Mission

Develop green advanced manufacturing technologies meeting the demand of the fourth industrial revolution



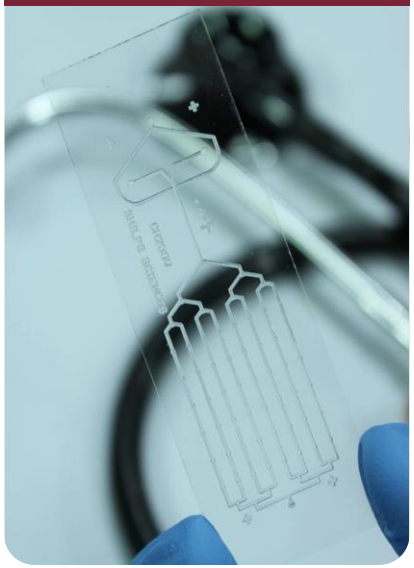

Electrochemistry
Material science
Microtechnology
Nanotechnology
Mechatronics
Mechanical engineering
Additive manufacturing post processing
Micromachining
Nanoscale surface engineering
Advanced manufacturing

Head of the Concordia Center for Advanced Manufacturing



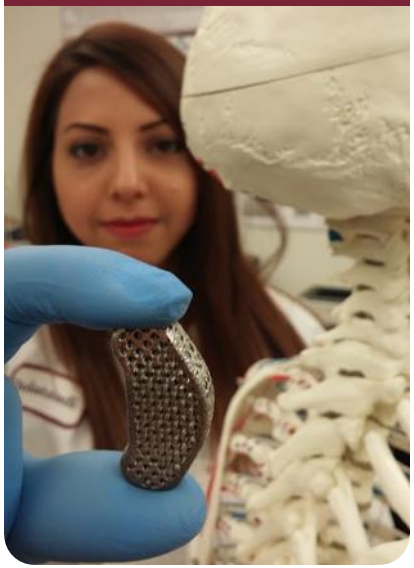
Our Expertise

Glass Machining



- Lab-on-Chip
- Multilayer chips
- Micro- to Macro-world interfaces

Post-Processing

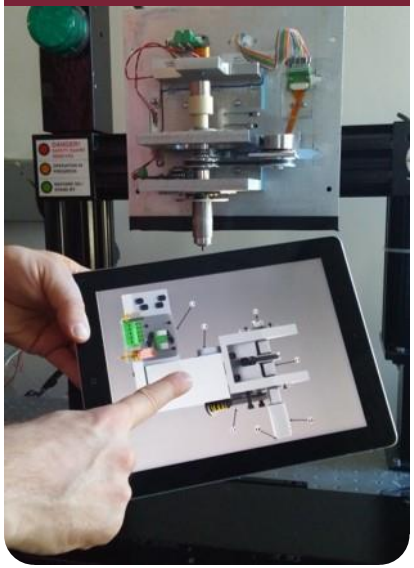


- Multiscale electro-polishing
- Down to Ra of 50nm
- Broad range of materials including Titanium

Coating

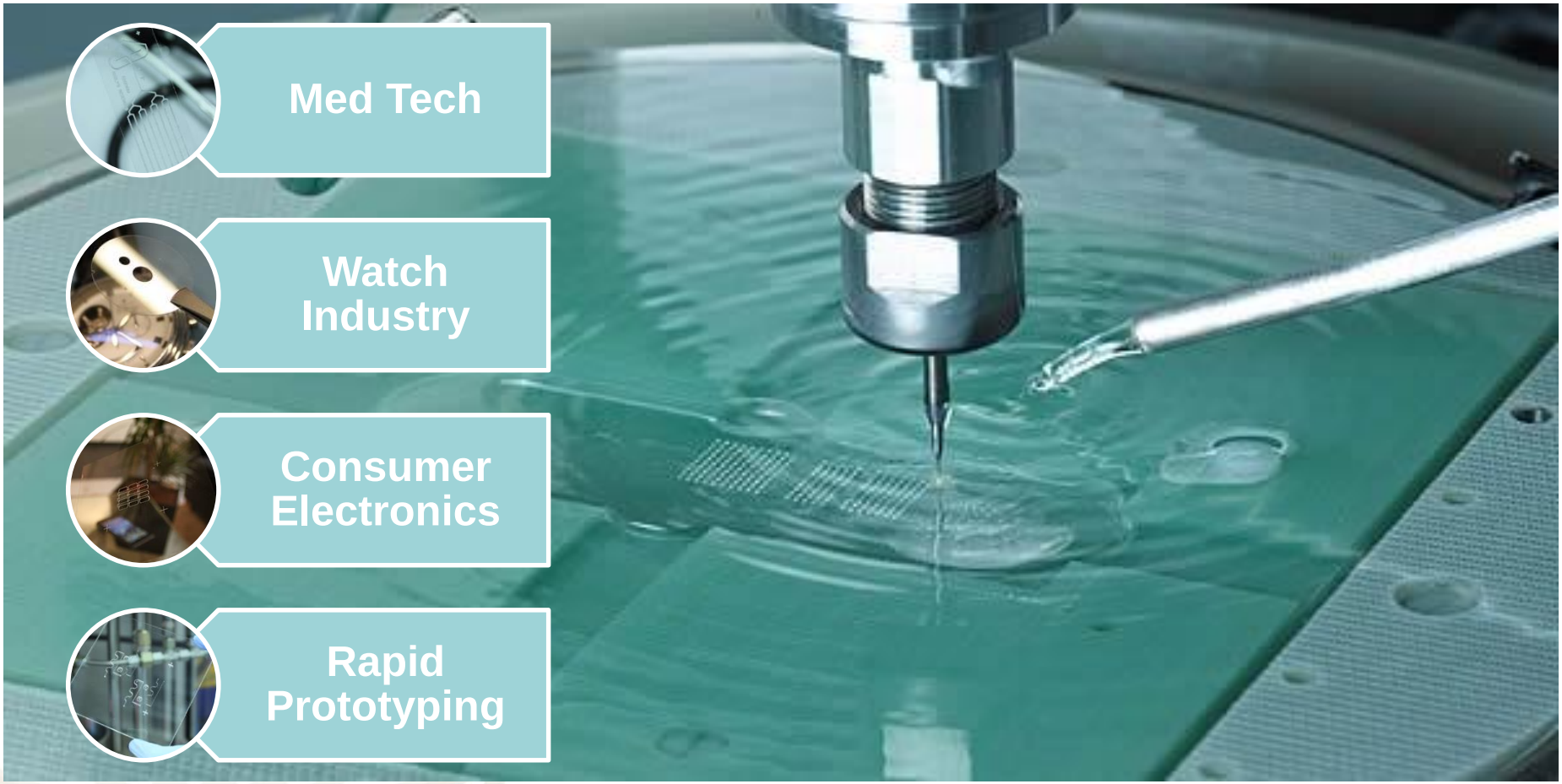
- Complex parts
- Wide range of substrate materials
- Tuning surface wettability

Industry 4.0



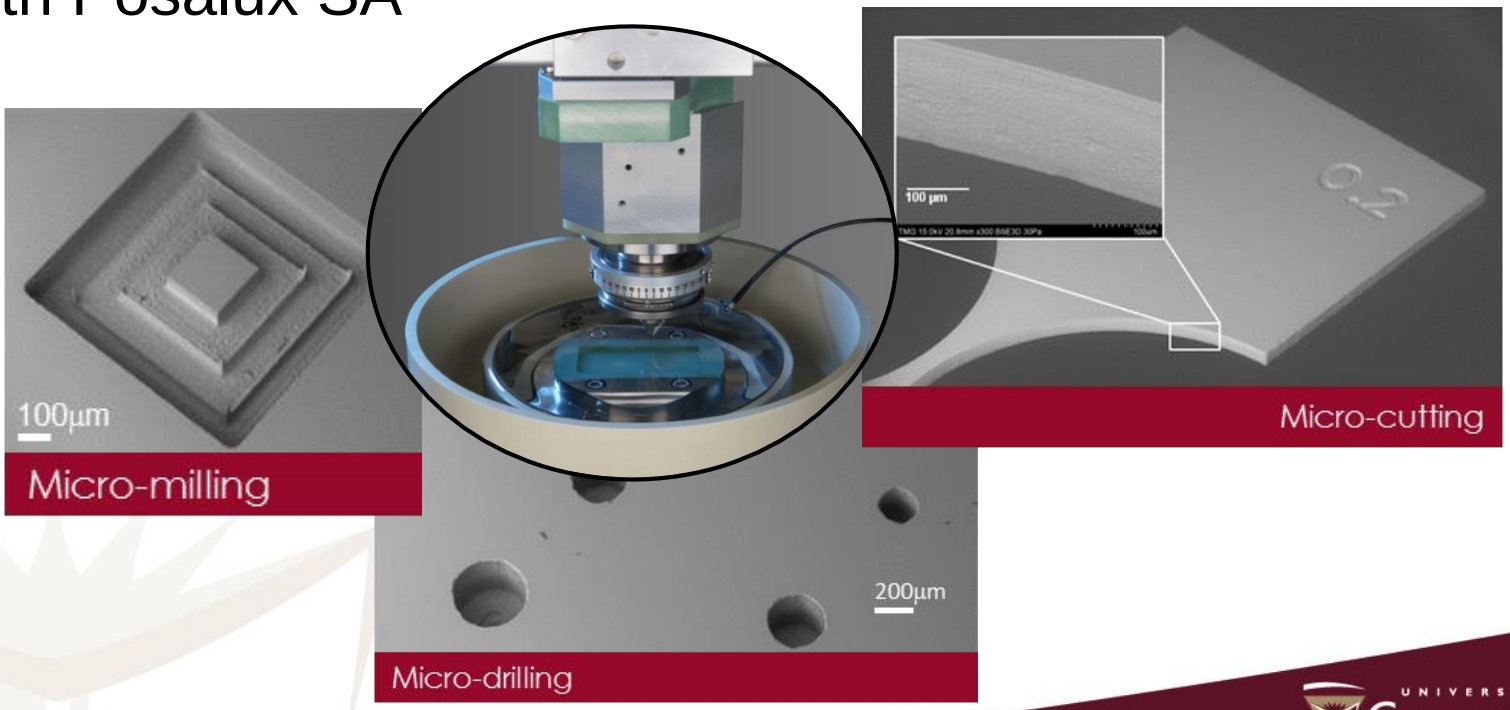
- Batch Size 1 production
- Internet of Things (IoT)
- Ultra low-cost tooling

Glass Micromachining

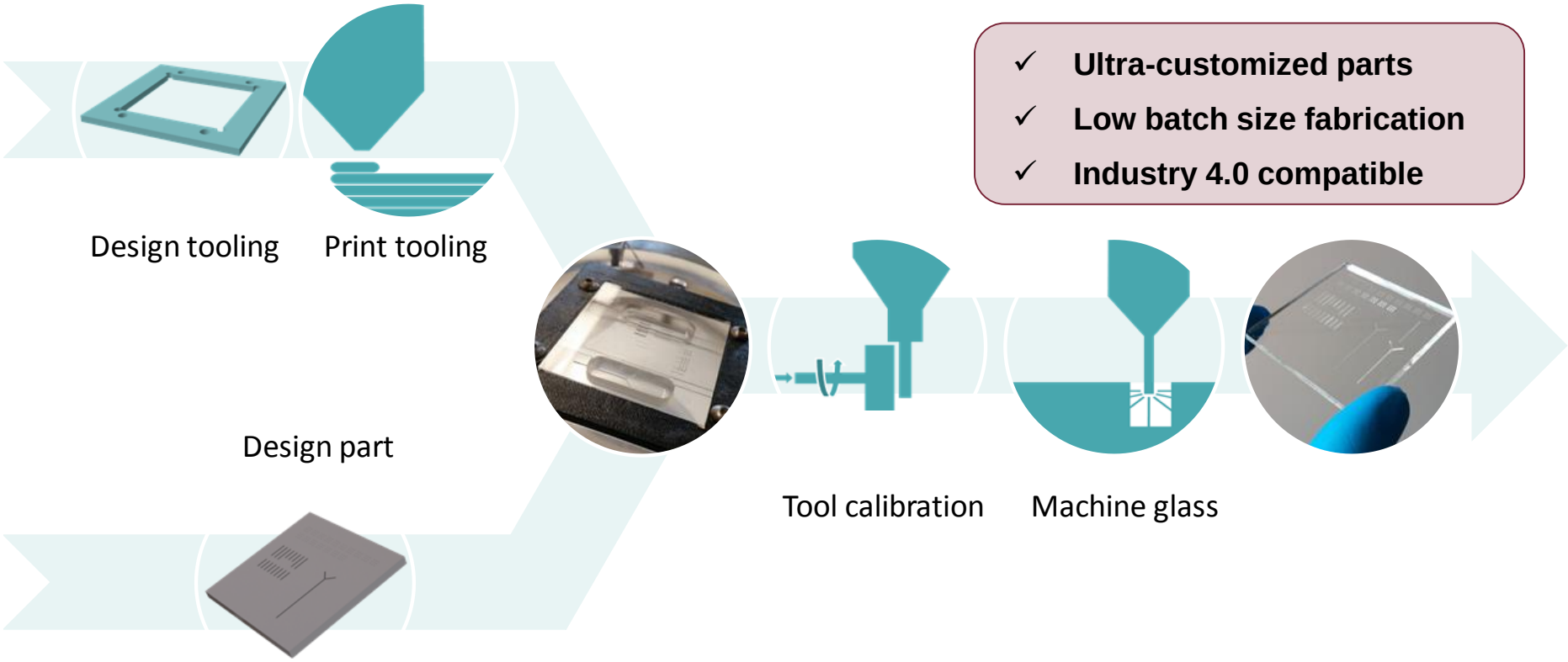


Spark Assisted Chemical Engraving

- World leading research group on SACE
- Industrialized technology with Posalux SA



Idea-to-realization by SACE

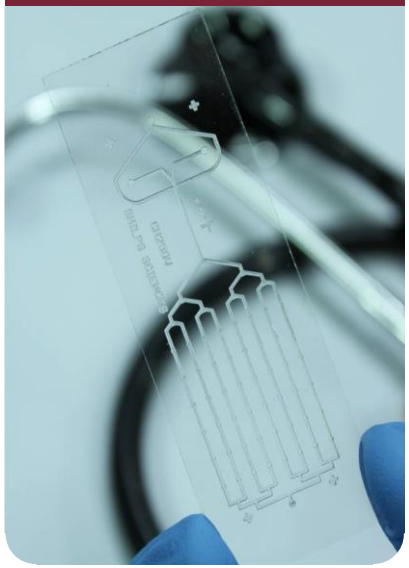


- ✓ **Ultra-customized parts**
- ✓ **Low batch size fabrication**
- ✓ **Industry 4.0 compatible**

- Low forces (~ 5 mN) exerted on workpiece during SACE machining
  → custom tooling can be 3D printed with ABS (corrosive resistant)
- ✓ No need for extra fixtures
- ✓ No disturbing of local electrolyte flow → high machining quality

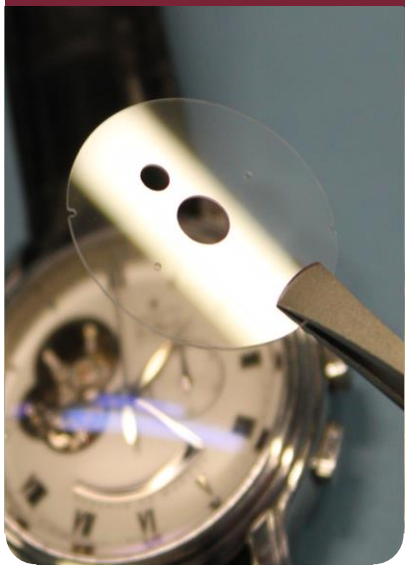
Applications

MedTech



- Lab-On-Chip
- Multilayer chips
- Micro- to Macro-world interfaces
- Micro-cutting

Watch Industry

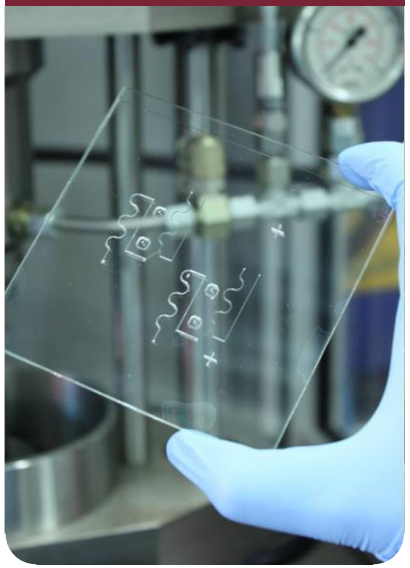


- Watchglass cutting
- Inner parts
- Anti-counterfeiting marks
- Localized glass strengthening

Consumer Electronics

- Drilling for Trough Glass Vias
- Micro-cutting of glass including thin (<300μm)
- Micro-cutting of hardened glass

Rapid Prototyping

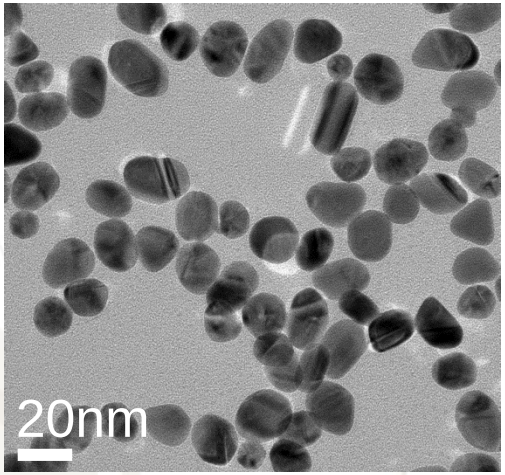


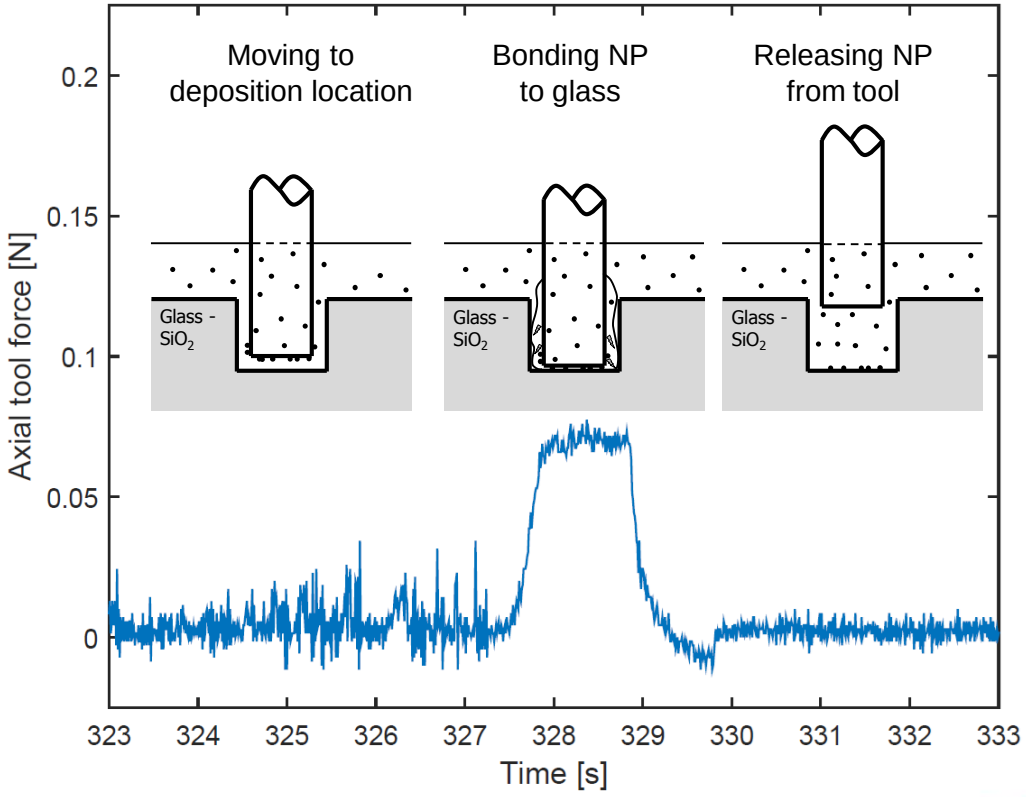
- Industrial R&D
- Fundamental Research
- Surface engineering
- **Batch Size 1 production**

Additive manufacturing on glass

Integrating additive manufacturing at the nano-scale with glass micro-machining by Spark Assisted Chemical Engraving (SACE)

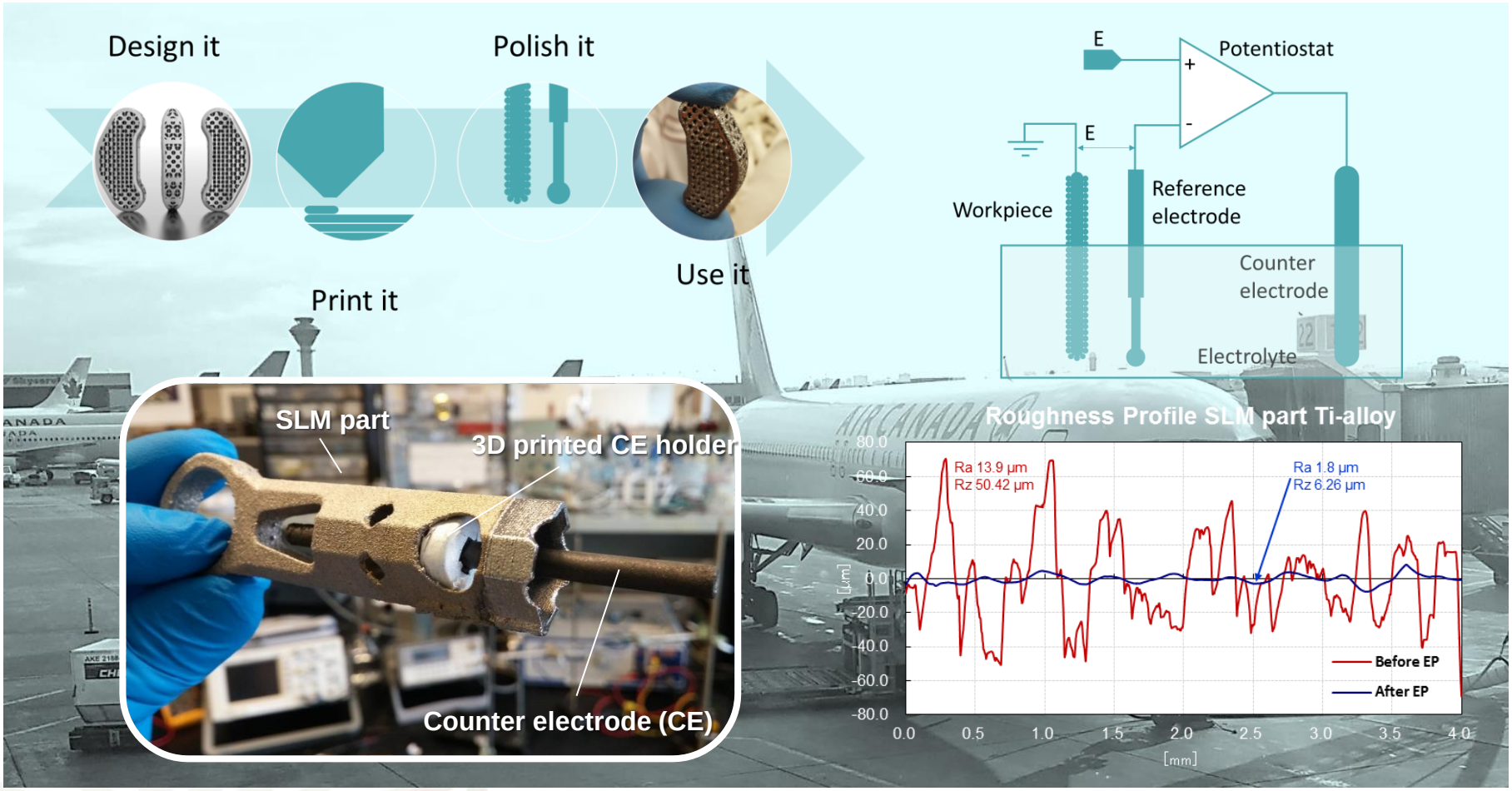
- Extending capabilities of SACE
- Local controlled stamping of nano-particles on glass





Université Concordia University

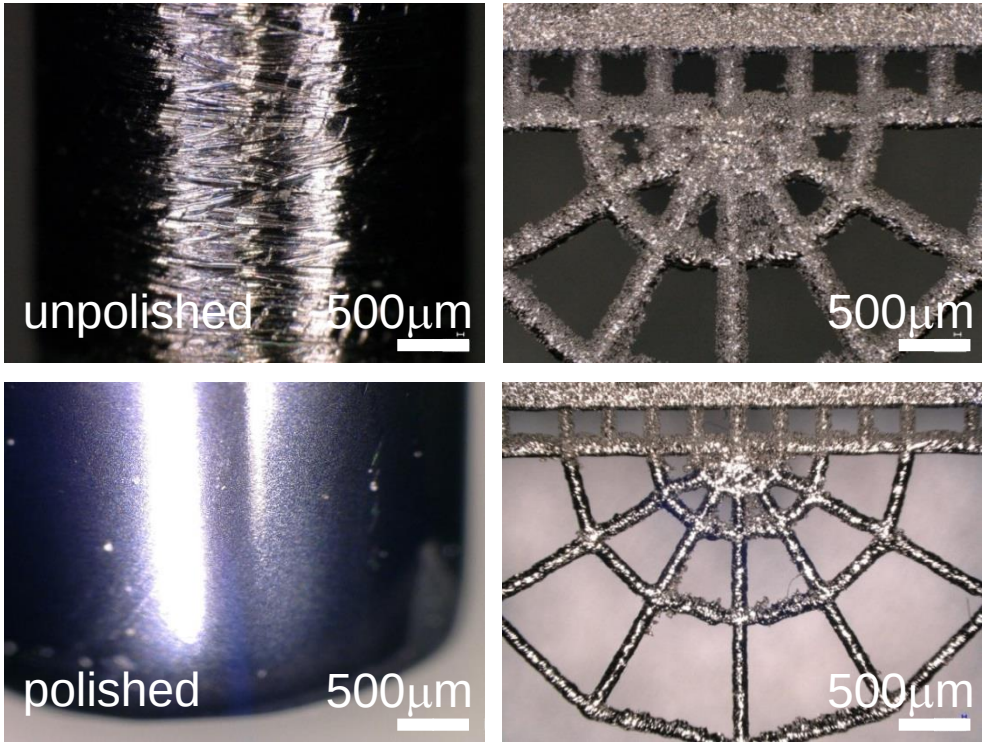
Electropolishing



Multi-scale electropolishing

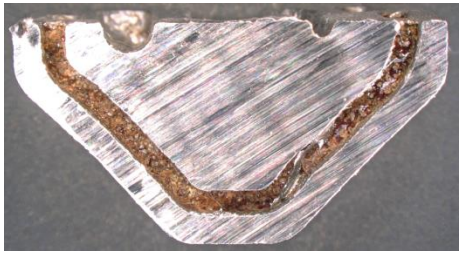
Multi-scale electropolishing of metallic parts built by additive manufacturing

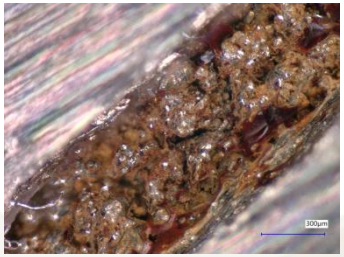
- Post-processing for additively manufactured Titanium parts
- Control of roughness at various scales (down to 50nm)
- Complex parts
- Green electrolyte

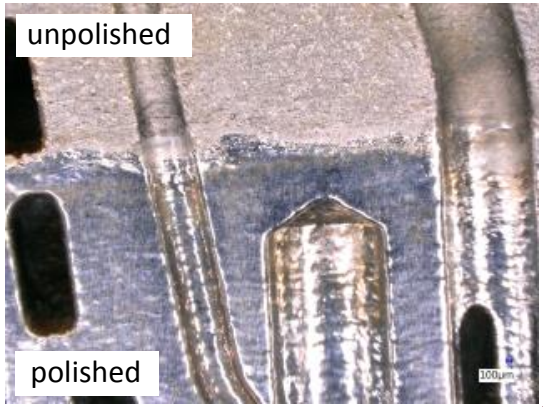


Polishing of Inner Surfaces

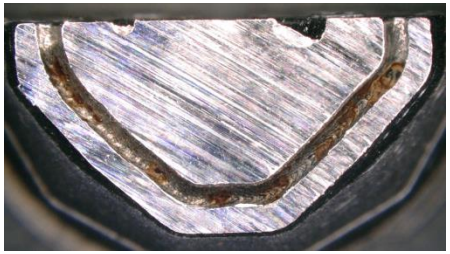
Unpolished

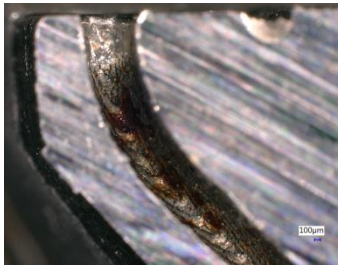


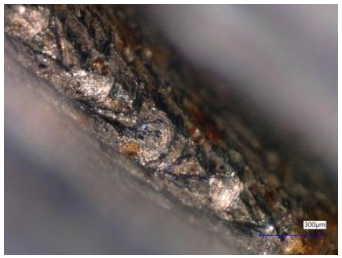




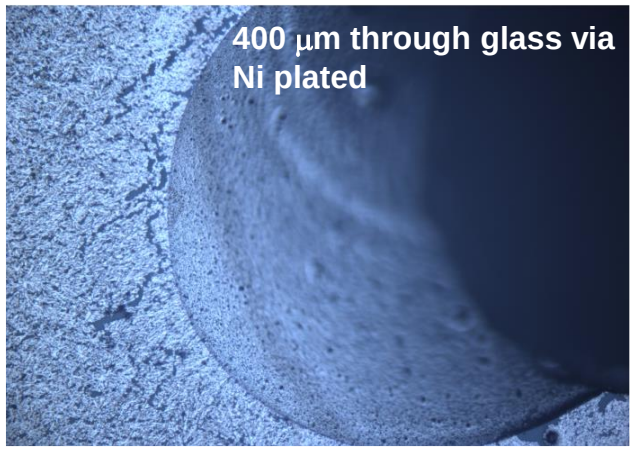
Polished

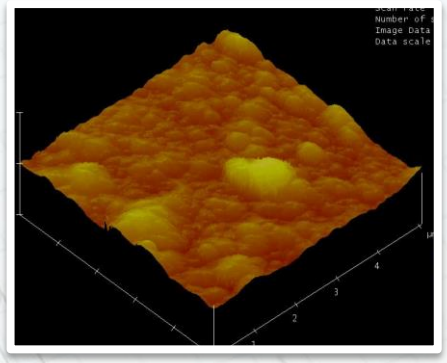




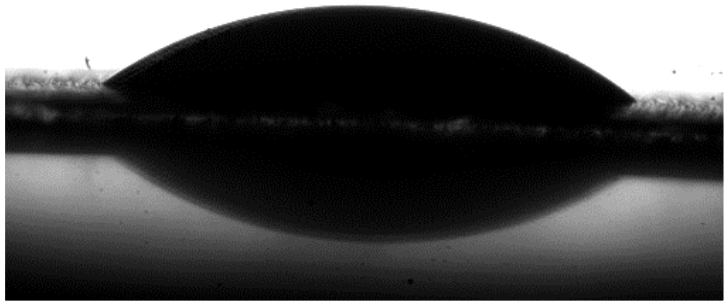


Surface Engineering

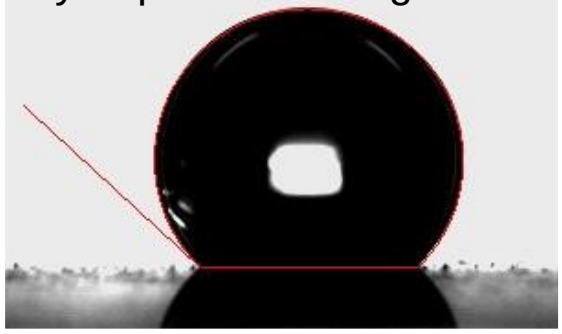




Hydrophilic coating



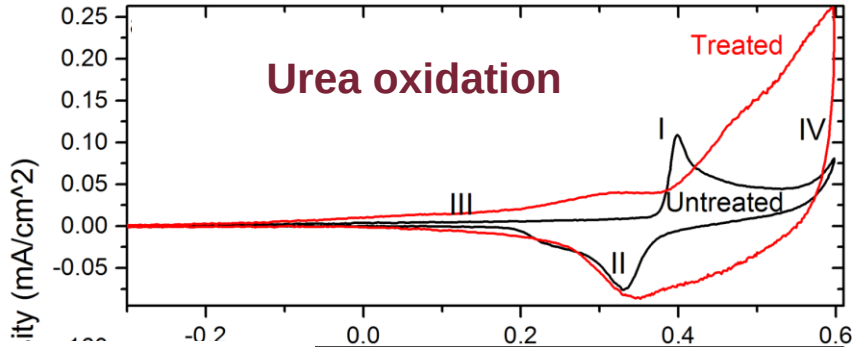
Hydrophobic coating

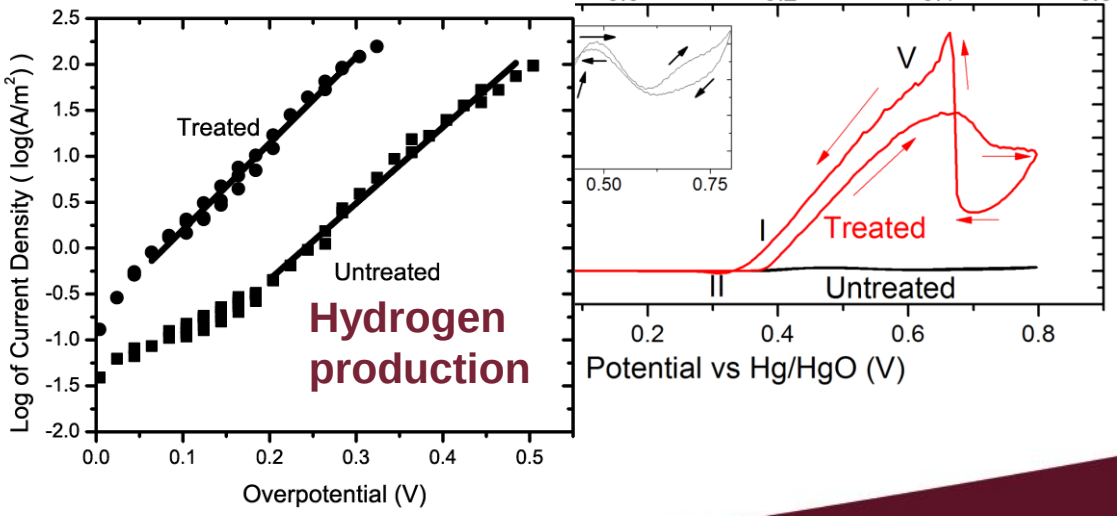


Engineered catalyst surfaces

Platinum-like Oxidation of Nickel Surface by Rapidly Switching Voltage to Generate Highly Active Bifunctional Catalysts

- Applicable to a large class of none-noble metals
- Catalyst for several important reactions
- In case of the hydrogen evolution reaction gives performances approaching the one of platinum
- Patented methodology

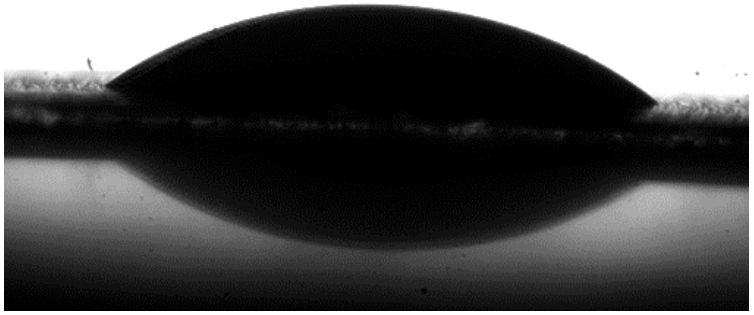


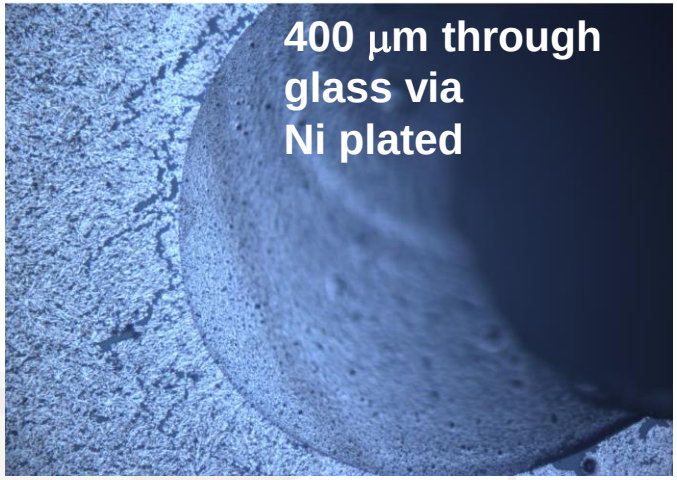


Nano-coating technology

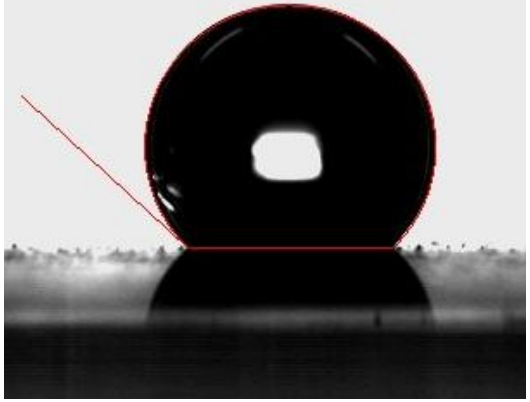
- Patented low-cost room temperature nano-coating technology
- Based on Taylor vortices and Langmuir-Blodgett films
- Licensed to Posalux SA

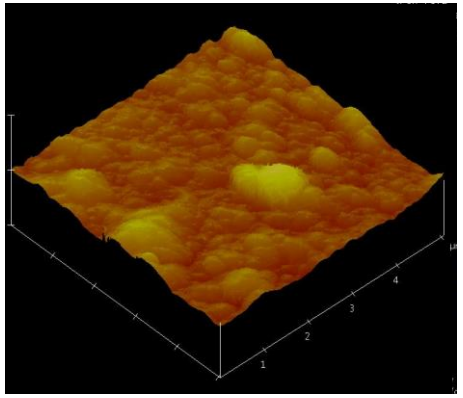
Hydrophilic coating



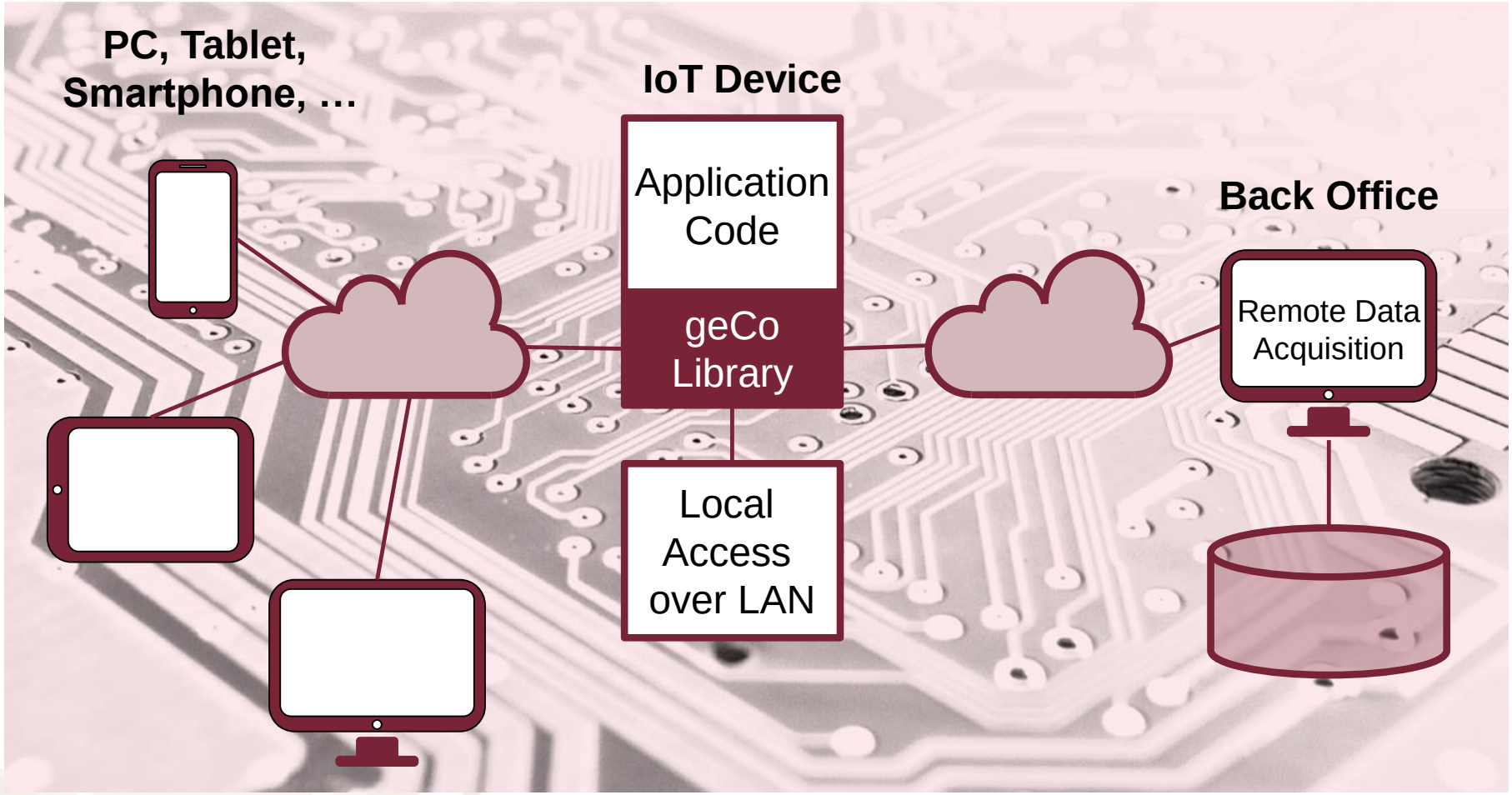


Hydrophobic coating





Industry 4.0

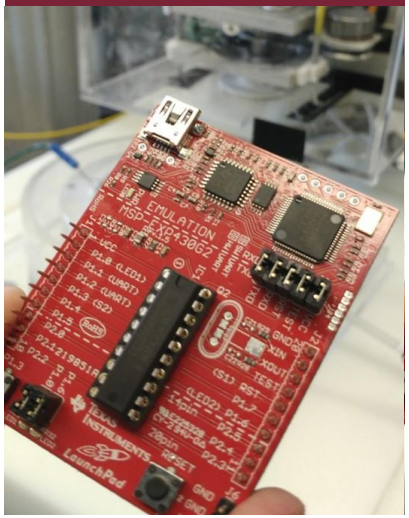

PC, Tablet,
Smartphone, …
IoT Device
Application Code
geCo Library
Local Access over LAN
Back Office
Remote Data Acquisition

geCo – General Framework for IoT Devices

Drive laboratory experiments

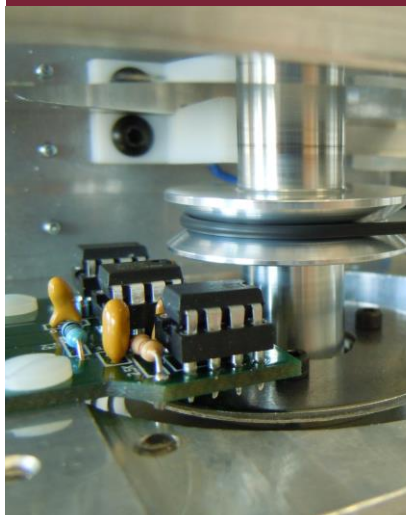
- ECTk : the electro-chemical tool kit
- LabTk : Open source LabView type software
- Human–machine interfaces (HMI)

Prototyping



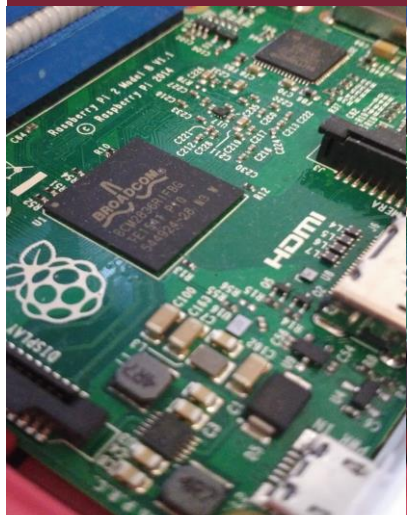
- Smart manufacturing processes
- Data flow
- IoT networks

Smart sensors



- Local controllers
- Data exchange
- Remote data acquisition
- Smart manufacturing
- Domotics

Education



- Educational platforms
- Raspberry pi
- Arduino

Current industrial partners

posalux
SWISS MADE

FlowJEM
Polymer Microfluidic Technology

micronit
MICROFLUIDICS
15th Anniversary

PASSIVE ACTION

RÉSEAU QUÉBEC 3D

AXIS
PROTOTYPES

Shilps Sciences

TERRAGON
Environmental Technologies Inc.

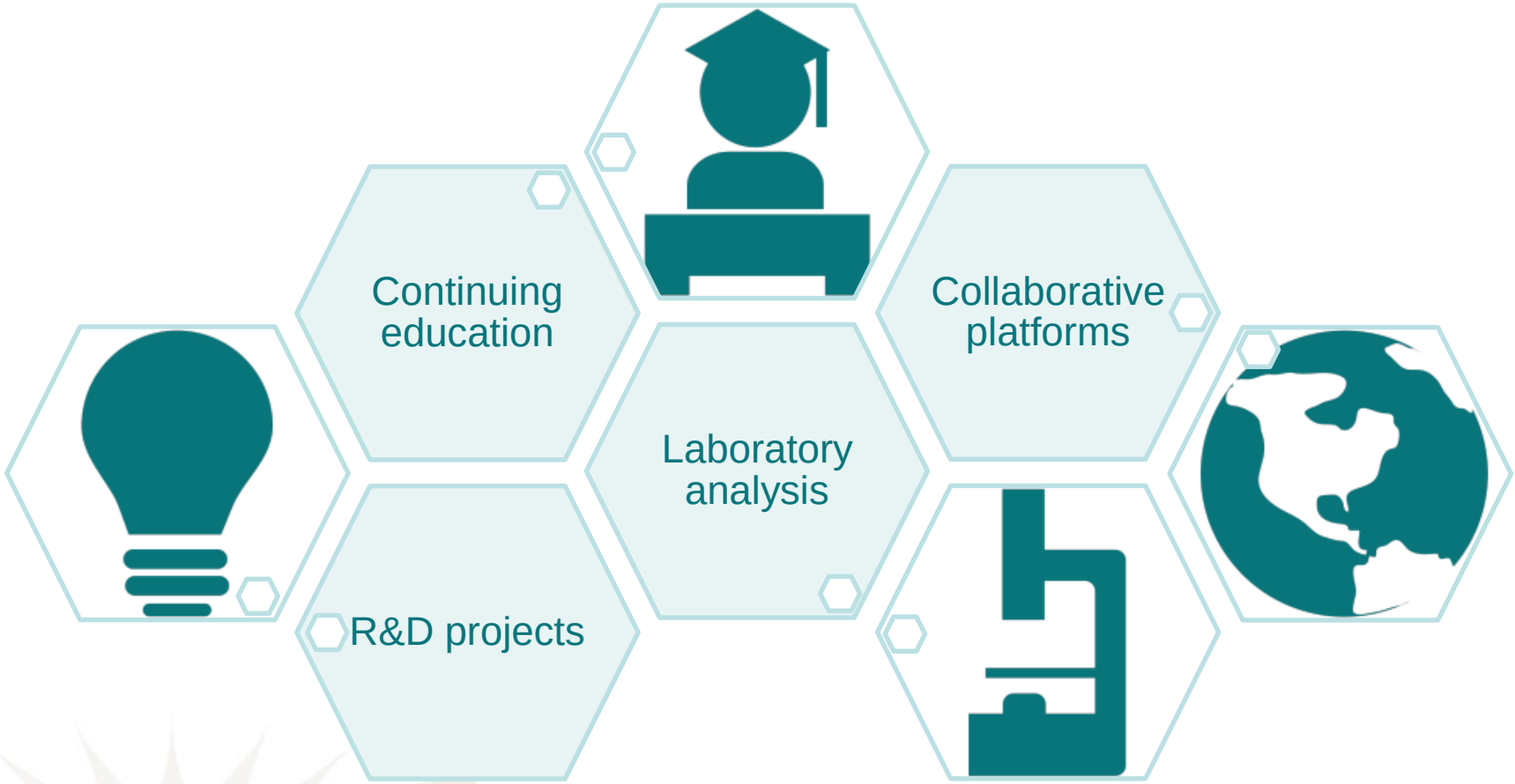
Arts & Techniques

Machine Tool Systems Inc.

AGC ASAHI GLASS

Université Concordia University

What we offer



THANK YOU

Electrochemical Green Engineering Group

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