



# SENTINEL

European Training Network in Single-Entity NanoElectrochemistry

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**2 early stage researcher opportunities available based at**

**Keysight Technologies**

Austria Laboratory, Linz

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## Project Descriptions

### **ESR6: GHz-AFM Spectroscopy of Electrochemical Processes with 0.5 aF Sensitivity**

This post will be co-supervised by the Pollard Institute at the University of Leeds.

Objectives: A fundamental project to assess a recently developed GHz-AFM (atomic force microscope) to study electrochemical processes at the nanoscale and at the single molecule level, as well as comparison to 3D physics modeling and impedance spectroscopy measurements at the bulk scale.

Expected Results: Development of measurement instrumentation including GHz-AFM and the use of electrochemical probes, and calibration methods for capacitance, conductivity, and impedance. Different high-sensitive measurements will be employed to assess the potential for real-world applications in electrocatalysis at the nanoscale.

### Planned Secondments:

- University of Twente - micro and nanofluidic for single-molecule analysis. The ESR will be exposed to microfabricated nanofluidic devices and their use in sensitive single-entity electrochemical detection experiments.
- University of Leeds - single cell and single molecule analysis using nanopipettes. The ESR will be trained on nanoelectrochemical methods for the manipulation of single-cells with single molecule resolution.
- Nippon Telegraph and Telephone (NTT) - Nanodevices for single-entity measurements. The ESR will learn about advanced nanofabrication techniques for the development of functional nanofluidics devices with single-entity sensitivity.

## ESR7: Next Generation High Frequency Instrumentation

This post will be co-supervised by the Centre for Electrochemical Sciences at Ruhr-University Bochum.

Objectives: This project will implement instrumentation that pushes the measurement limits to sub-fA sensitivity at 100 MHz frequency for single-molecule and single nanoparticle detection.

Expected Results: The new instruments will reveal the electrochemical activity of single nanoparticles or molecules with unprecedented time resolution.

Planned Secondments:

- Ruhr-University Bochum - assessing electrocatalysts with nanoimpacts. The ESR will be exposed to the chemical analysis of single nanoparticles and will be trained on electrocatalytic measurement at the single nanoparticle level, with applications to fuel cells.
- University of Paris Diderot - hyphenation of electrochemical imaging with optical tomography. This secondment will enable the ESR to couple high-resolution optical microscopies to nanoelectrochemical techniques, providing in operando complementary visualisation of single electrocatalytic nanoparticles
- East China University of Science & Technology - functional probe design for chemical sensing. The ESR will have the opportunity to become familiar with methods for imparting chemical functionality to nanopipettes/nanopores for single molecule sensing.

## About the Employer

Keysight Technologies is one of the world's premier electronic measurement companies with 13.000+ employees. Keysight offers a portfolio of different high speed oscilloscopes and vector network analysers (VNA) that are at the cutting edge of performance, speed, and sensitivity. Keysight Technologies Austria GmbH includes one of the leading cooperate research labs on the impedance measurements at nano-scale and bulk-scale, as well as high frequency VNA technology including source-meter units (SMU).

The Keysight Austria laboratory is equipped with the latest technology for high frequency impedance measurements at nanoscale and bulk-scale, including high speed oscilloscopes, 50 GHz and 67 GHz PNAs, large stage 5600 AFM (20x20 cm sample plate), 9500 and 7500 Electrochemistry-AFM, two microwave universal nose cones, microwave generators, handheld network and signal analysers (FieldFox) and source meters SMU B2900 and current analyser CX3300, all from Keysight. The modelling suite EMPro2018 is used for microwave 3D simulations to compare with experiments, as well as circuitry design ADS2018.

The PhD enrolment at the University will be done through Johannes Kepler University (JKU) Linz.



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