



SENTINEL

European Training Network in Single-Entity NanoElectrochemistry

**Early stage researcher opportunity based at
Elements SRL**

Project Description

ESR12: Pico-Potentiostat for Nano-Electrochemical Measurements

This post will be co-supervised by the French Alternative Energies & Atomic Energy Commission (CEA) Paris-Saclay Civil Research Centre.

Candidates with a background in the physics of semiconductors are particularly desirable.

Objectives: This project focuses on the development of a new class of ultra low-noise, low cost and easy to use instruments and data analysis software to enable the access to nano-electrochemical measurements to a wide scientific and R&D industrial community. The semiconductor physics behind the ultra-low noise measurements will be also investigated.

Expected Results: A working prototype of a pico-potentiostat and demonstration of applications of the new instruments and measurement techniques in the industrially relevant process (oxygen evolution and reduction, electrocatalysis, single molecule nanopore sensing).

Planned Secondments:

- CEA - theoretical electrochemistry for sustainable energy materials. CEA will empower the ESR with numerical simulation skills that will be applied to the study of nanoelectrochemical systems.
- University of Warwick - modelling of interfacial properties at the nanoscale. The ESR to will gain hands on experience of finite element method modelling (COMSOL platform) to treat experimental data and for experimental design.
- 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

Elements SRL is an innovative Italian SME established in December 2013 that design and produces electronic instrumentation for the pico- and nano-scale measurements in the electrochemistry field, ranging from electrophysiology on live cells to bio- and solid-state nanopore sensing.

Elements technology is based on custom ASICs (CMOS silicon microchip), designed by the company's team of microelectronics engineers, which allows ultra-low noise current measurement starting from very low ranges (few hundreds of fA, 10^{-15} Ampere).

Elements microchips facilitate the production of miniaturised devices, that are affordable, portable and easy-to-use, and that enable nanotechnologies to be used in the new generation of portable medical diagnostic devices (Point-of-Care-Testing) and food safety controls. In this sense Elements is committed to *enabling technology for life science*.

Elements' miniaturised amplifier can acquire and analyse very low ion currents and can be applied in the electrophysiology/electrochemistry field. Ion currents are electric signals flowing through ion channels (nanometric-sized pore-forming proteins on cell membranes). Ion channels are involved in many life processes of cells and are crucial in order to analyse the impact of drugs on human cells.

Historically Elements products have been distributed at a global level across countries such as USA, Japan, the People's Republic of China and most European countries. In addition, the company collaborates with leading European companies in the electrophysiology field contributing to the innovation of measurement systems in the automatic electrophysiology field.

Elements has equipment for electronic and microelectronic prototyping, assembly and testing, plus workstations equipped with CAD for semiconductor ASIC design and simulation.

Enrolment in this post would be through the University of Bologna, Department of Physics.



SENTINEL has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement no. 812398