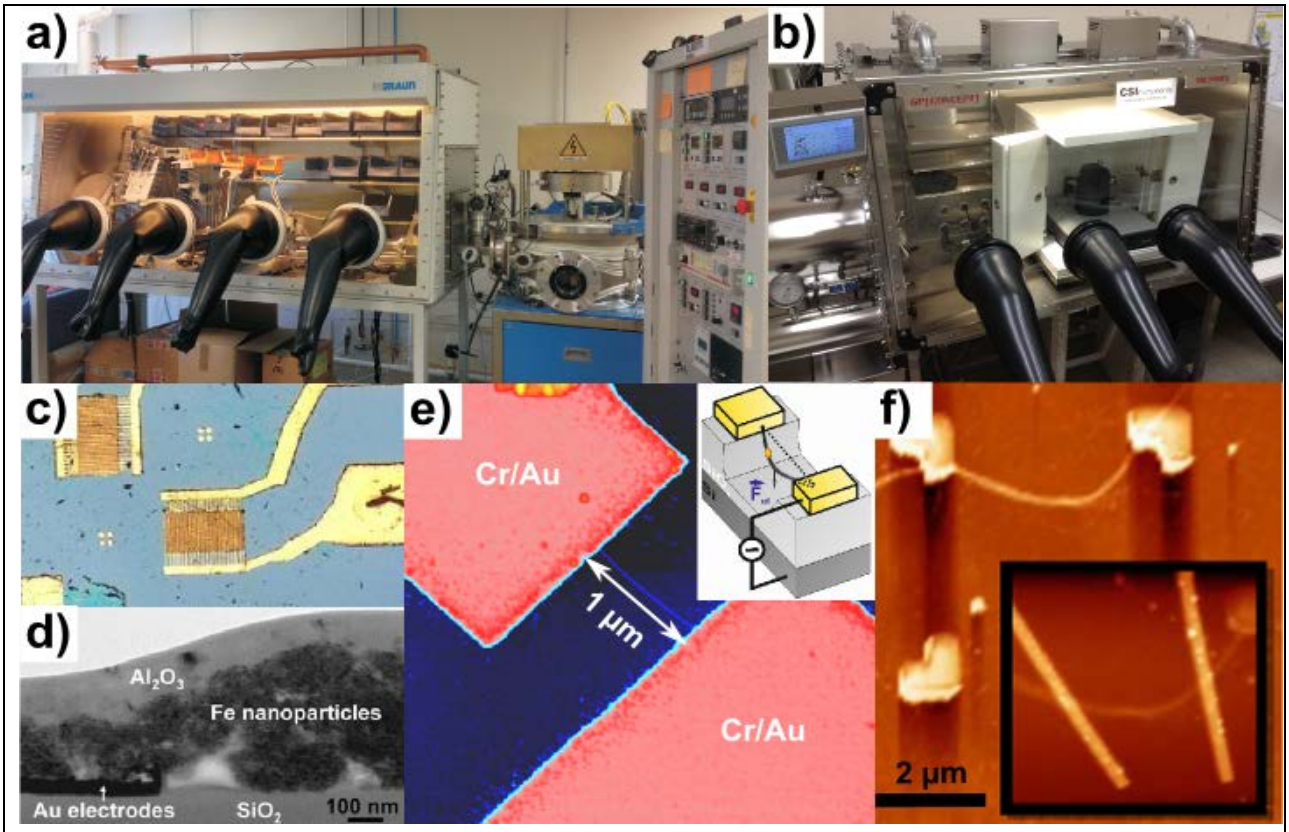
PRONANO Plateform (Electronic and magnetic PROperties of chemically-grown NANO-objects)



a) Ultra High Vacuum thin film deposition system from Plassys coupled with an M-Braun glove box under Ar atmosphere. b) Nano-observer (CSI) multimode AFM inserted in a Jacomex glove box under Ar atmosphere. c) and d) Fe nano-sphere deposited by dielectrophoresis on top of Au inter-fingered electrodes and capped with a Al_2O_3 layer. e) AFM image of a carbon nanotube connected to two Cr/Au electrodes. The nanotube diameter is 1nm. Insert : Scheme of a carbon nanotube mechanical resonator allowing to make magnetometry. A single NO is grafted onto the nanotube. f) AFM image of an Au nano-wire bundle connected to two Cr/Au electrodes. The bundle height is 20nm.

The detailed studies of the electronic and magnetic properties of chemically grown nano-objects (NOs) require keeping the NOs free from oxygen and water in order to conserve their shape and to avoid contamination and oxidation which will deteriorate drastically the NO intrinsic properties.

To achieve this goal we have developed a technological platform able to address, connect, manipulate, observe and characterize NO in an inert atmosphere without oxygen, and water. This technological platform is based on two coupled systems. The first system is a four hands glove box under Ar atmosphere coupled to an Ultra High Vacuum thin film deposition system from Plassys (see figure a)). Inside the glove box we have installed several deposition techniques like drop casting, dip coating, spin coating and dielectrophoresis. The UHV thin film deposition system is connected thanks to a transfer chamber. With this system we can depose metal layer to connect the NO (figure e) and f)) or oxide layer to protect the NO from oxidation (Al_2O_3 capping layer on top of Fe nano spheres, figure d)). The second system is a multimode Atomic Force Microscope (AFM Nano-observer from CSI)) inserted in a specially designed three hands glove box (see figure b)). Thanks to the different modes available with the AFM it is possible to:

- Localize and characterize the NO dimensions deposited on Si/SiO_2. Thanks to this imaging step, the NO can be contacted with e-beam lithograpy (figure e) and f)) in order to probe the electronic and magnetic properties under magnetic field and low temperature.
- Study the magnetic properties of NO network deposited onto a substrate thanks to the magnetic mode imaging.
- Perform local electronic properties measurement on individual NO thanks to the Resiscope mode developed by CSI.