

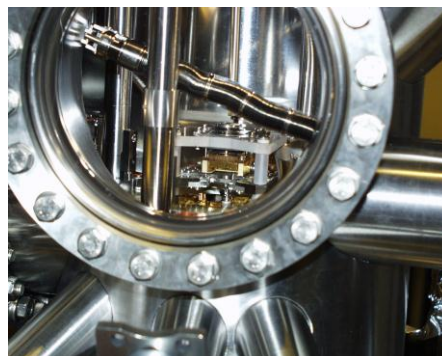
The STM group: Experimental Surface/Nano- Chemistry and Nanomagnetism/Quantum transport group.

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The Scanning Tunnelling Microscopy group has two major lines of research activities nanomagnetism/magnetodynamics/quantum transport and surface science/nanochemistry, with common instrumentation. There are three ultra high vacuum STM:s operated by the group. In addition to this a large effort is made in instrument design, with the construction ferro magnetic resonance spectrometers, and high bandwidth STM(<40 GHz) for studies of magnetodynamics.



Surface science

The surface science activities are primarily directed towards experimental investigations of adsorption behaviour at bimetallic surfaces by scanning tunnelling microscopy (STM) and high-resolution photoelectron spectroscopy (HRPES). The HRPES studies are performed at MAX-lab, the synchrotron radiation laboratory at Lund University, Sweden. Another line of research are studies of thin TiO₂ films and adsorbates on anatase and rutile TiO₂ surfaces through collaboration with Uppsala University. Main topics:

- Adsorption at PdAg and PdCu single crystal surfaces
- Adsorbates at anatase and rutile (TiO₂) surfaces
- Alkali metal growth at Co surfaces
- Topologically non-trivial states at surfaces, studied through STM and photoemission

Experimental Nano-magnetism and Quantum transport

The research on nanomagnetism is dedicated to understand the physics of magnetic structures at the nanoscale, as well as magnetoresistance at the nanoscale. In particular STM based transport measurements in combination with ferro magnetic resonance are utilised to understand how charge and spin currents within materials interplay with the magnetisation of materials. A main line of research is performed in conjunction with the Department of Electronics and Telecommunications (Prof. T. Tybell) to study functional metal oxides. We also pursue a line of research with more fundamental nature – to utilise point contact spectroscopy for energy dependent studies of quantum interference effects such as weak localisation, weak anti localisation and universal conductance fluctuations (quantum transport properties). In particular we are interested in for Dresselhaus like spin split systems (graphite, graphene). A summary of activities are:

- Nanostructuring and magnetic properties of La_{1-x}Sr_xMnO₃
- Temperature and energy dependent studies of the Dirac like

bands in Graphite - interference effects and backscattering.

- Ferro magnetic resonance studies of antiferromagnets coupled to ferromagnets (in collaboration with New York University).

Master/Project Assignments:

In principle the group can offer an assignment in any of the fields above or related, please come to us to discuss in detail. For discussions on projects with Erik as supervisor please use email, since he is on sabbatical leave until July 2012. We also welcome candidates that are interested in continuing their master project with a PhD in the same line of research. For the fall 2012/spring 2013 we can offer the following specific assignments:

1) Oxidation of Pd-based bimetallic single crystal surfaces: Cu and Ag are used as alloying elements in palladium-based hydrogen permeating membranes, for example used in fuel cell applications. For both PdAg and PdCu systems heat treatment in air is improving the hydrogen flow through these materials, but the actual physical effects behind this improvement are not well known. The present project will include investigating ordered oxide formation on the PdCu or PdAg surfaces by STM and possibly by high resolution photoelectron spectroscopy measurements at the synchrotron facility MAX-lab.

2) Alkali metal growth on cobalt surfaces: Cobalt based catalysts are essential for production of synthetic diesel from natural gas, biomass or coal through the so-called Fischer Tropsch synthesis. Small amounts of alkali metals, present in biomolecules, which are the starting point for the production process, are found to influence the activity and selectivity of the catalyst. In this project the behaviour of alkali metals on cobalt surfaces will be addressed through studying growth of Na or K on Co single crystal surfaces using scanning tunnelling microscopy. The project is in collaboration with prof. Hilde Venvik, Department of Chemical Engineering

3) Spin pumping at ferromagnet/antiferromagnet interfaces:

For device technology it is very important to understand the dynamic properties of both magnetisation and spin currents in materials. The studies are devoted towards understanding these properties, extracting proper describing parameters, and how size effects effects this. To do this we utilise dynamic characterisation ranging up to the 40 GHz region, primarily EPR/FMR. This project involves synthesis and in NanoLab combined with, EPR/FMR studies in the home lab.

4) Study of quantum interference effects in Graphite/Graphene: In this project point contact spectroscopy is used to probe scattering and interference/backscattering in graphite. In particular we study and compare the properties of the Dirac like E1 and E2 bands of graphite which share properties with graphene with those of graphene.

5) Interface resistance of Iron/graphite: In this project the magnetoresistivity of point contacts to nm-thick iron films grown onto graphite will be characterised. This yields insight into how the scattering process at the interface works, and how it relates to the relative changes in bandstructure as the magnetisation of the Iron film is manipulated.