



Fritz-Haber-Institut der Max-Planck-Gesellschaft





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DE GRUYTER

*Jeremiah James, Thomas Steinhauser,
Dieter Hoffmann, Bretislav Friedrich*

ONE HUNDRED YEARS AT THE INTERSECTION OF CHEMISTRY AND PHYSICS

THE FRITZ HABER INSTITUTE OF
THE MAX PLANCK SOCIETY 1911–2011



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This volume, occasioned by the centenary of the Fritz Haber Institute, formerly the Institute for Physical Chemistry and Electrochemistry, covers the Institute's scientific and institutional history from its founding in 1911 as one of the earliest institutes of the Kaiser Wilhelm Society, through its renaming for its founding director in 1952 and incorporation in the Max Planck Society, until the present. The Institute's pace-setting research in physical chemistry and chemical physics has been shaped by dozens of distinguished scientists, among them seven Nobel Laureates.



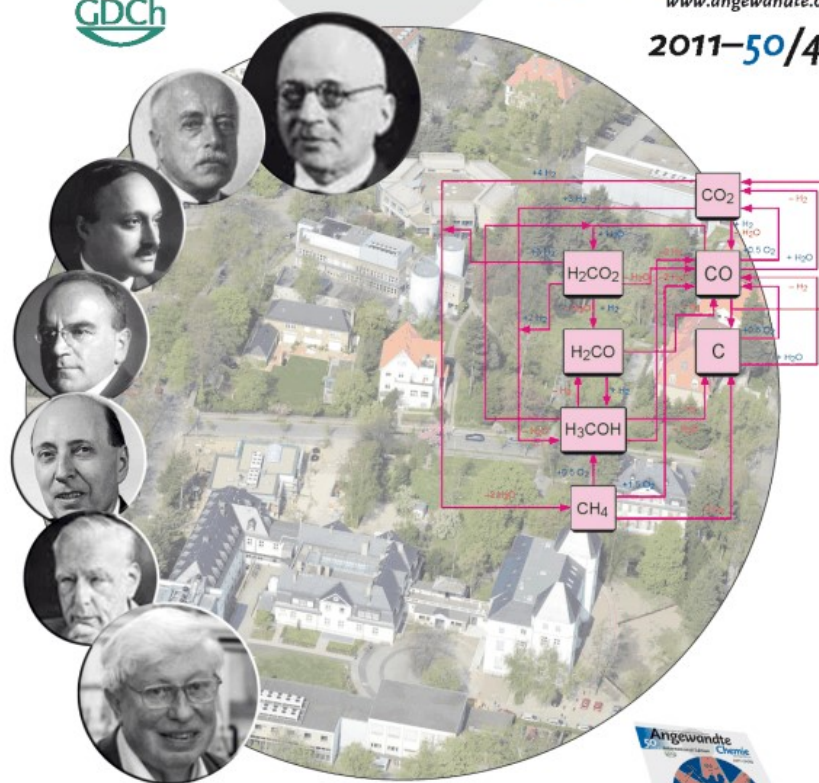
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**Special Issue for the 100th anniversary of the Fritz Haber
Institute of the Max Planck Society, including articles from
H.-J. Freund, G. Meijer, M. Scheffler, R. Schlögl,
M. Wolf, H. Schwarz, G. Somorjai**

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The staff

- Currently, the institute has 42 positions out of which 24 are tenured for scientists, and 152 positions for technical staff including the service groups.
- The institute typically supports 80-100 PhD students. Many of them are paid through outside funding. The institute operates a Max-Planck International Research School (IMPRS) for graduate students, “Complex Surfaces in Materials Science”.
- The Fritz Haber Institute has actively supported the career of young scientists. The institute has seen 25 habilitations over the last 15 years.
- Within the same period, 40 scientists have been appointed to high academic positions at universities.
- The institute also hosts about 10 apprentices in its various scientific departments and service groups.



Fritz-Haber-Institut der Max-Planck-Gesellschaft

FHI Departments



Inorganic Chemistry
Prof. Robert Schlögl



Chemical Physics
Prof. Hajo Freund



Molecular Physics
Prof. Gerard Meijer



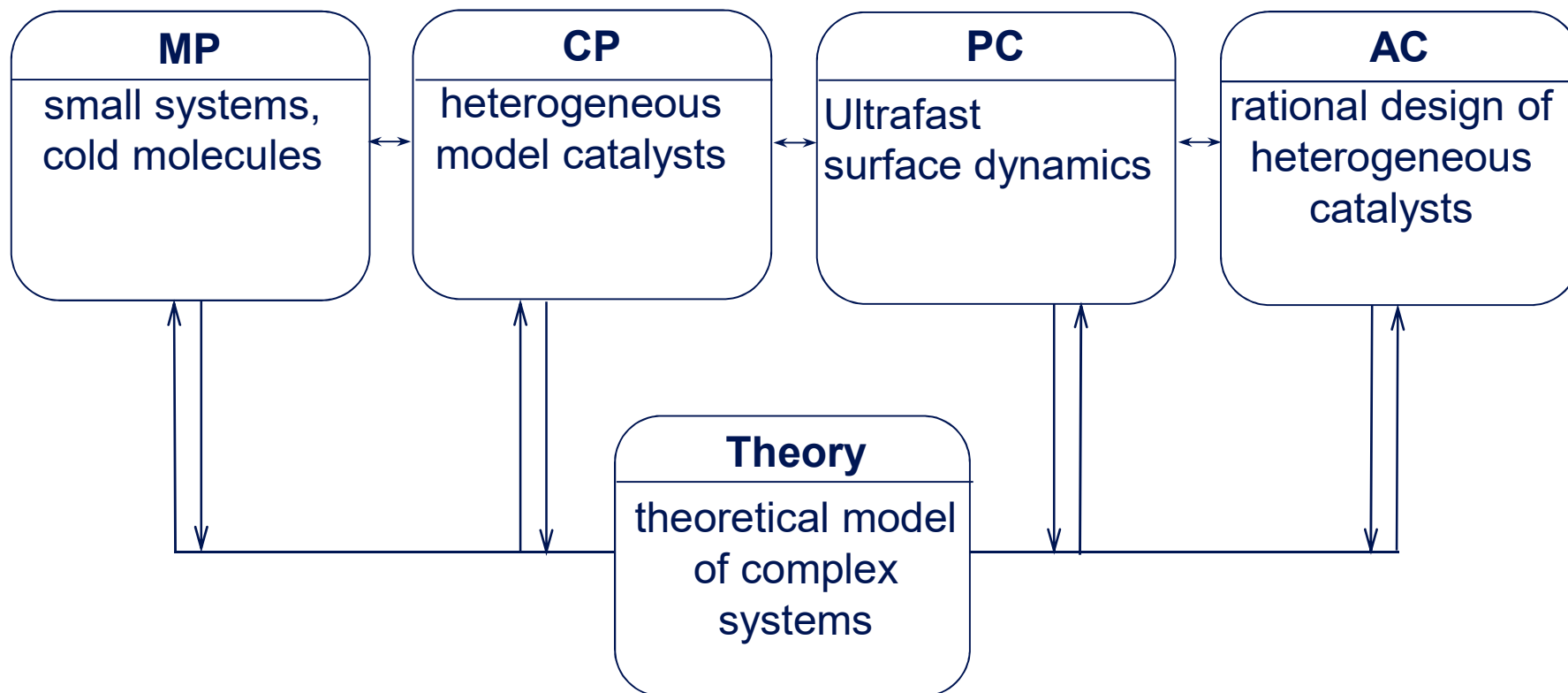
Physical Chemistry
Prof. Martin Wolf



Theory
Prof. Matthias Scheffler



Atomic Understanding of Heterogeneous Catalysis





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BESSY/EMIL

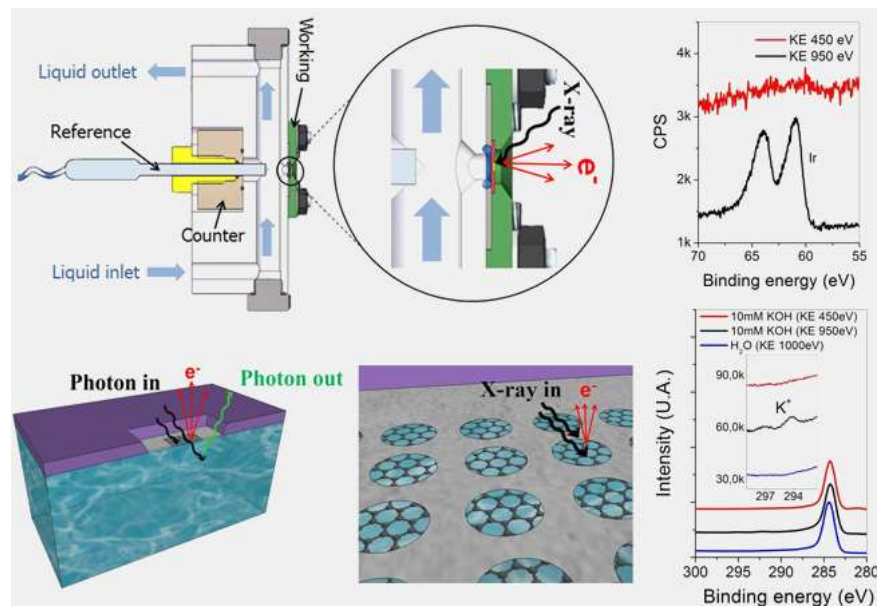


Soft X-ray absorption spectroscopy
(SXAS)

X-ray photoelectron spectroscopy at
ambient pressure
(AP-XPS)

Department Inorganic Chemistry
(Director R. Schlögl) A. Knop-Gericke

X-ray photoelectron spectroscopy in
the presence of liquids in
electrochemical reactions





Future experiments @ SIRIUS

Sirius, the new Brazilian Synchrotron Light Source



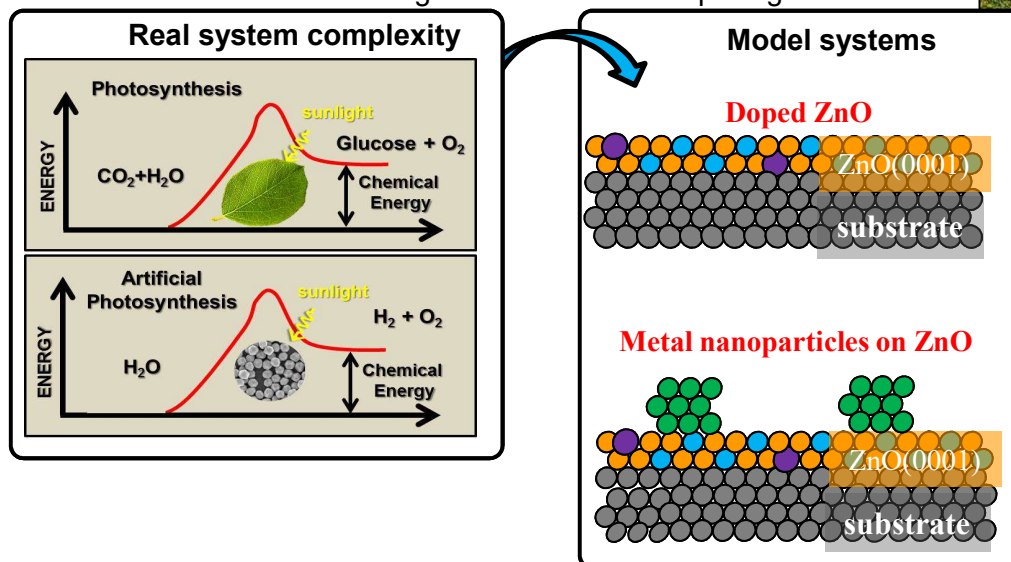
Photo at www.lnls.cnpem.br/sirius



F. Stavale @ Brazilian Center for Research in Physics
Surface and Interface Phenomena Group Max-Planck Partner Group for
The Surface Science approach towards Artificial Photosynthesis:
Tailoring oxides photocatalytic properties through doping and nanoparticles

A closer-look at Artificial Photosynthesis:

An atomic-scale investigation on the Water Splitting Reaction

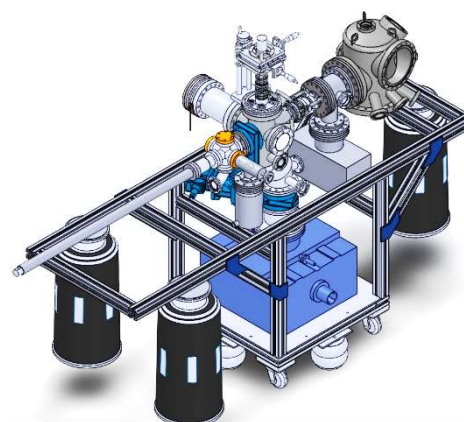


Joint-Workshop in Rio (2017)



<https://sites.google.com/view/ws2rio/home>

DONNATED VT-STM OMICRON @ CBPF (2018)



Stavale et al., in Encyclopedia of Interfacial Chemistry, Elsevier (2018)

Contact to Brazil

People



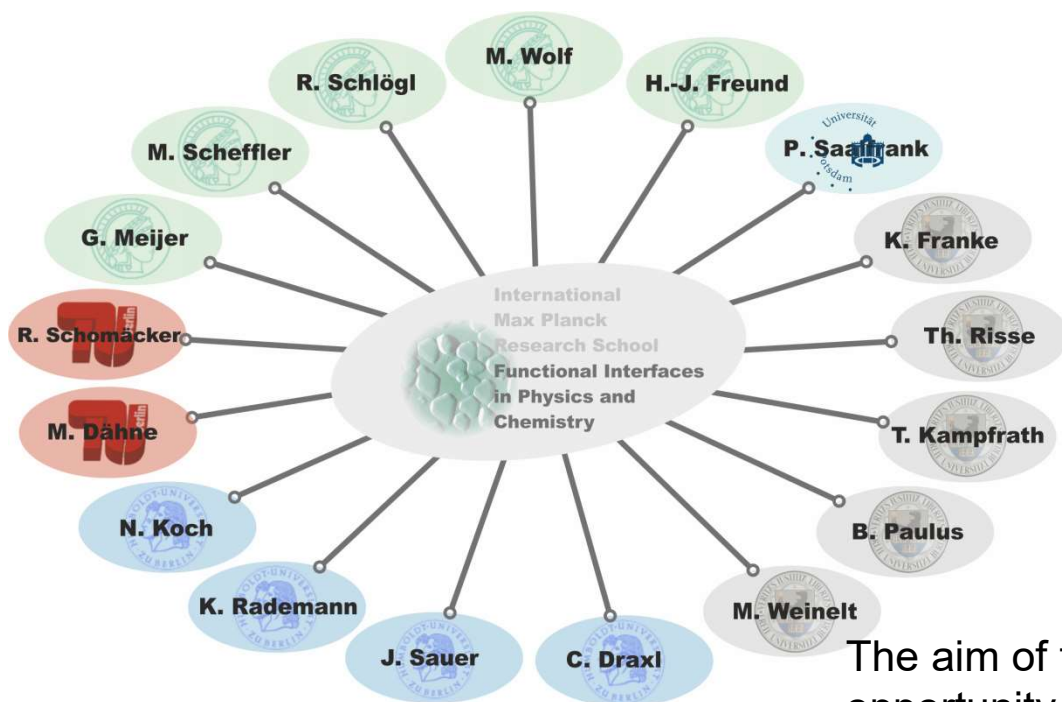
Professor Martin Schmal, Ufrj Coppe

Martin Schmal has been recipient of a Senior Humboldt Award in our Department in 2002.

In contact since 1995 through „1st German Brazilien Workshop on Applied Surface Science“ and I have been Foreign Member of the Academia Brasileiro de Ciencias since 2004.

International Max Planck Research School

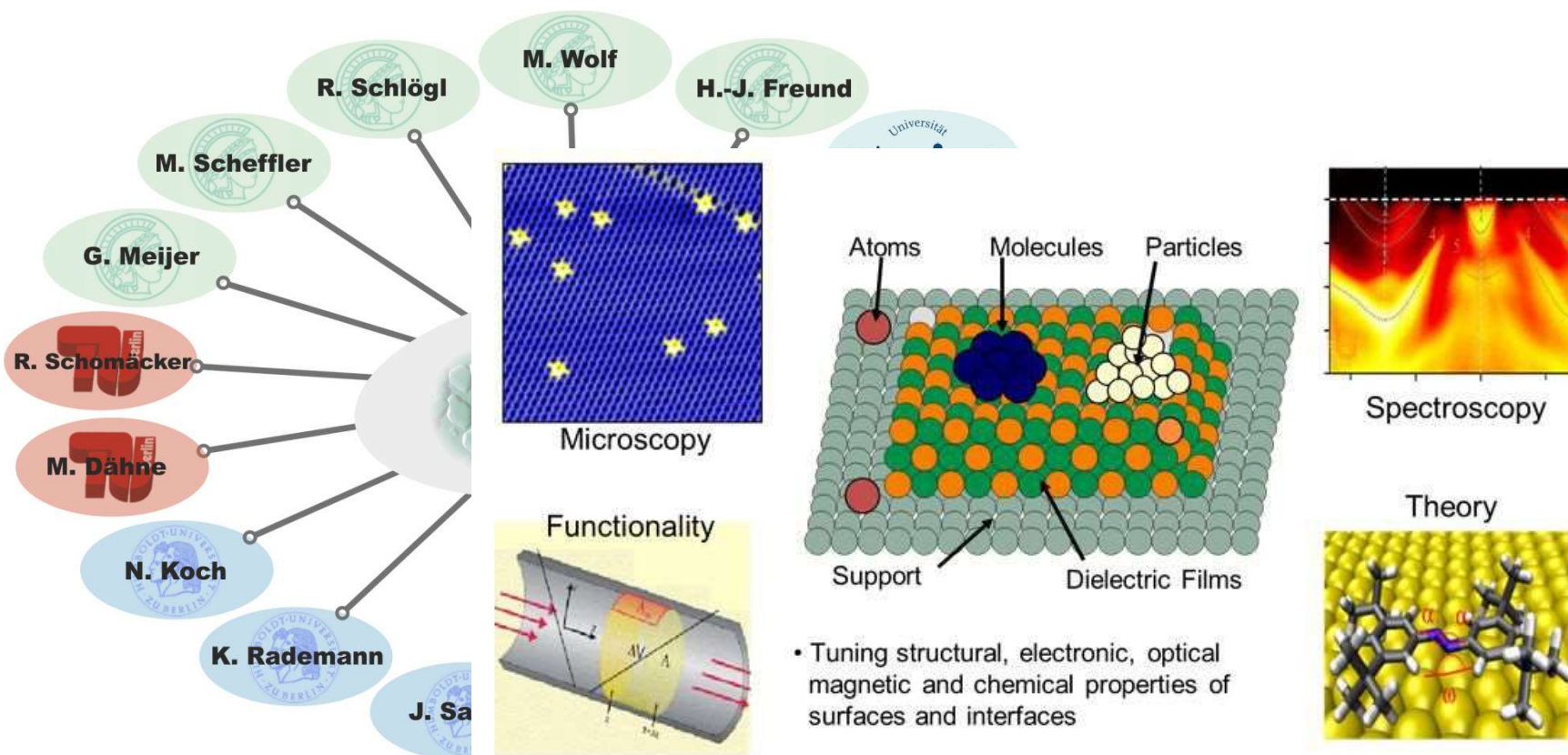
Participants



The aim of the school is to provide a unique opportunity for foreign and German students in terms of cutting-edge research and a thorough training in the methods, concepts and theoretical basis of the physics and chemistry of functional interfaces.

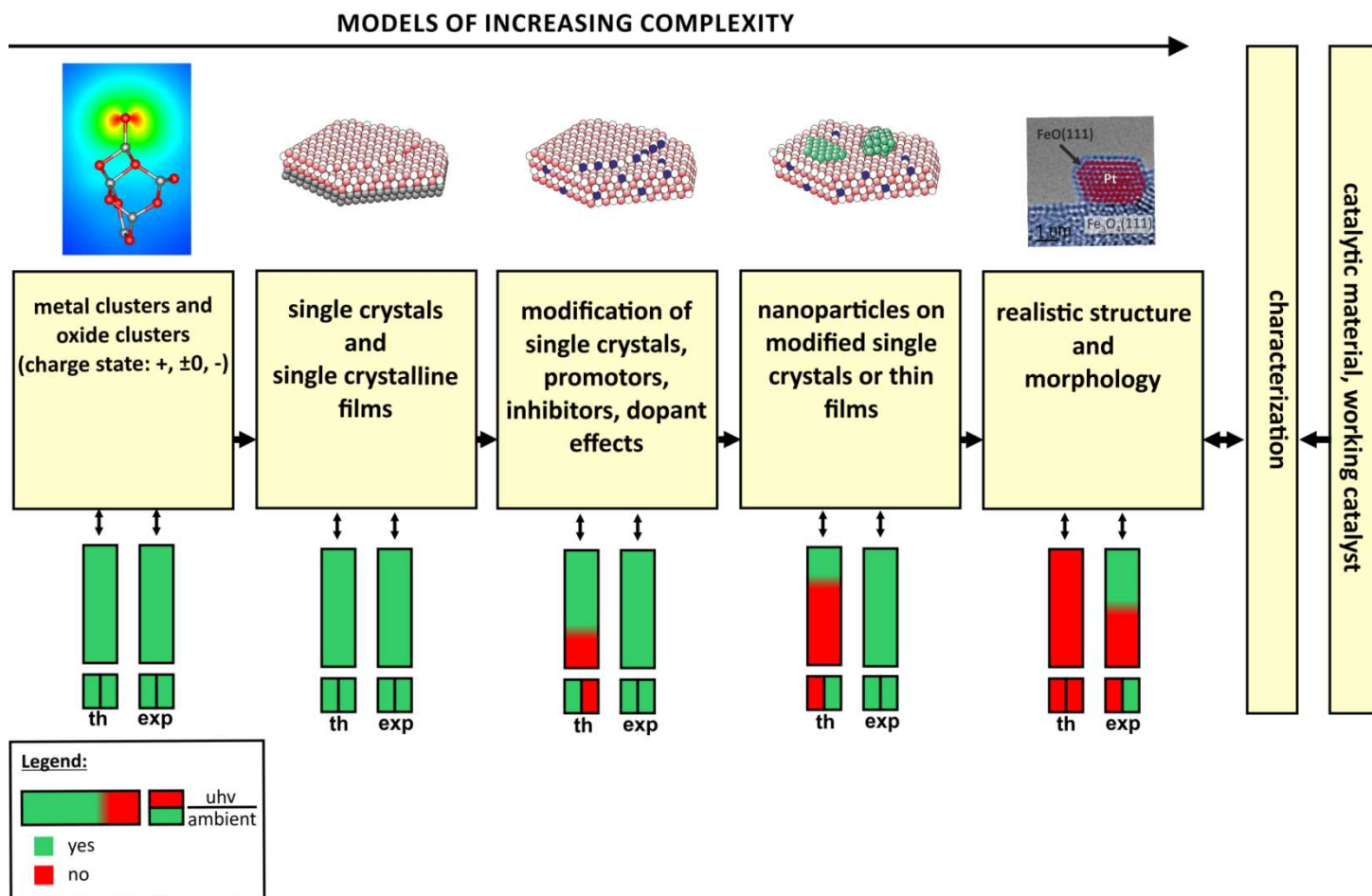
International Max Planck Research School

Topics



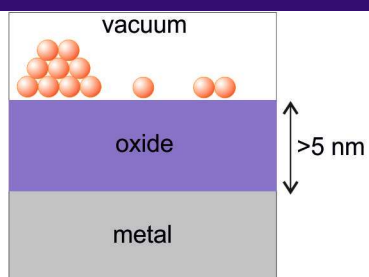
Model Systems

Scenarios

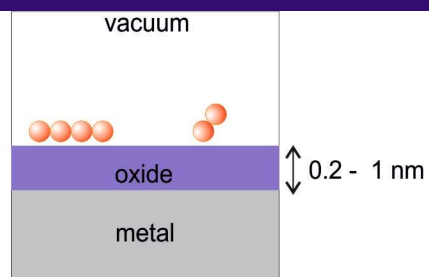


Thin Oxide Film Systems

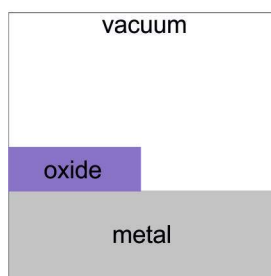
Scenarios



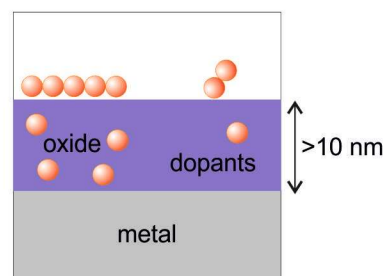
a)



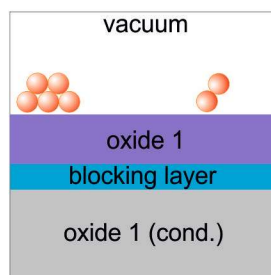
b)



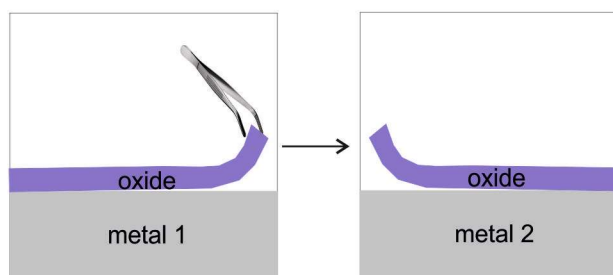
c)



d)



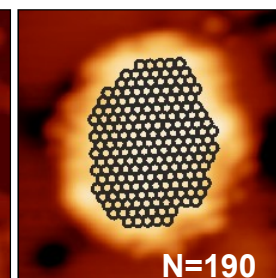
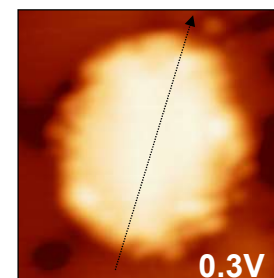
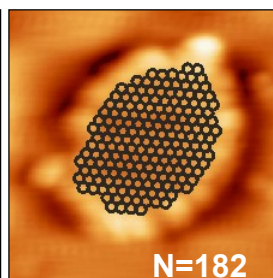
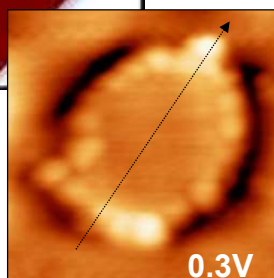
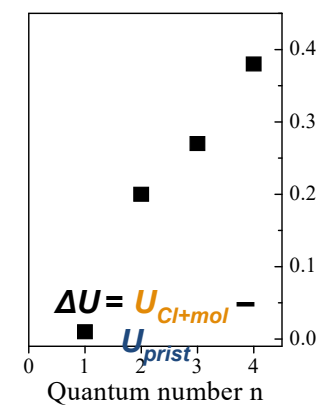
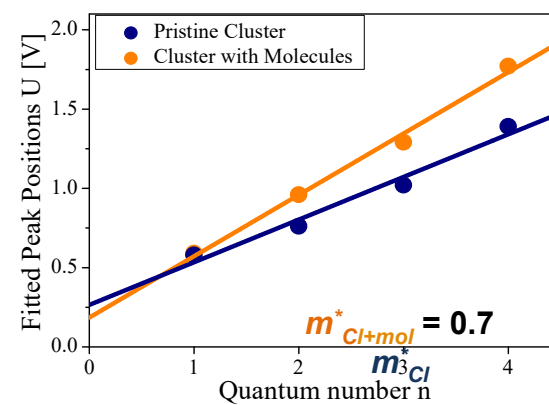
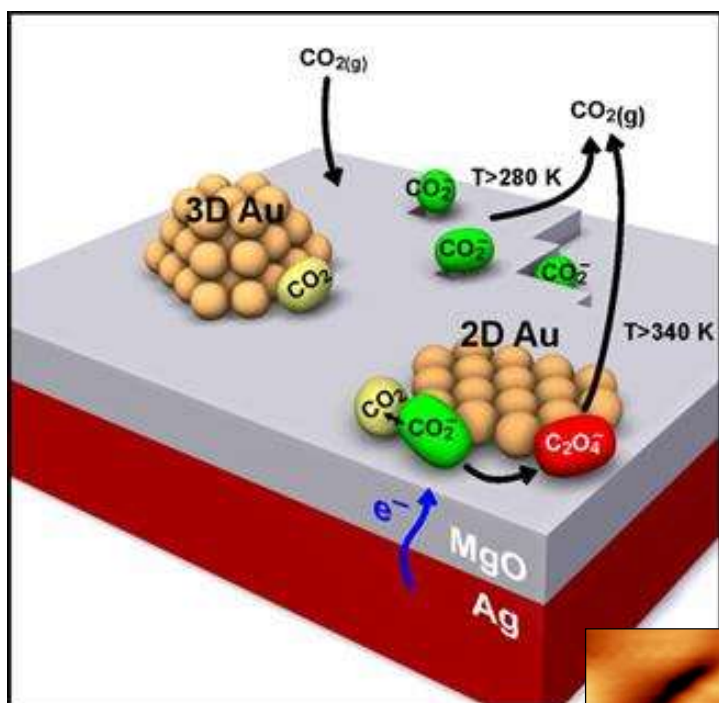
e)



f)

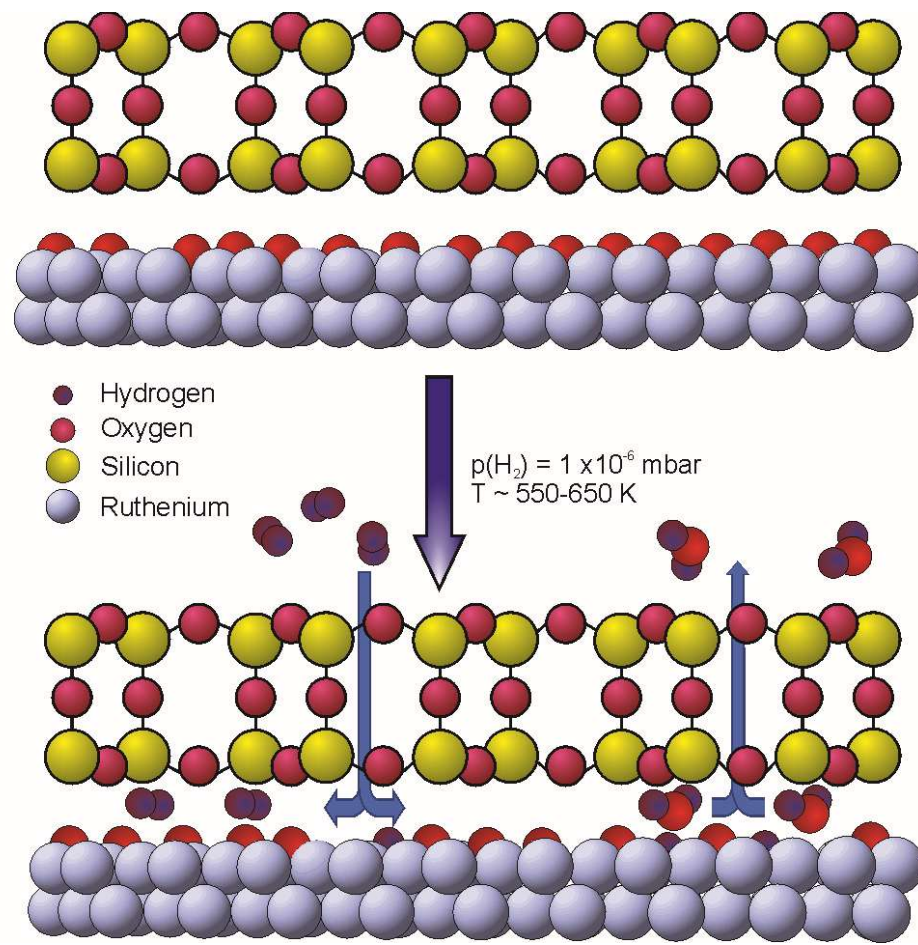
Carbon Dioxide Activation

Influence of 2D→3D Morphology on Reactivity



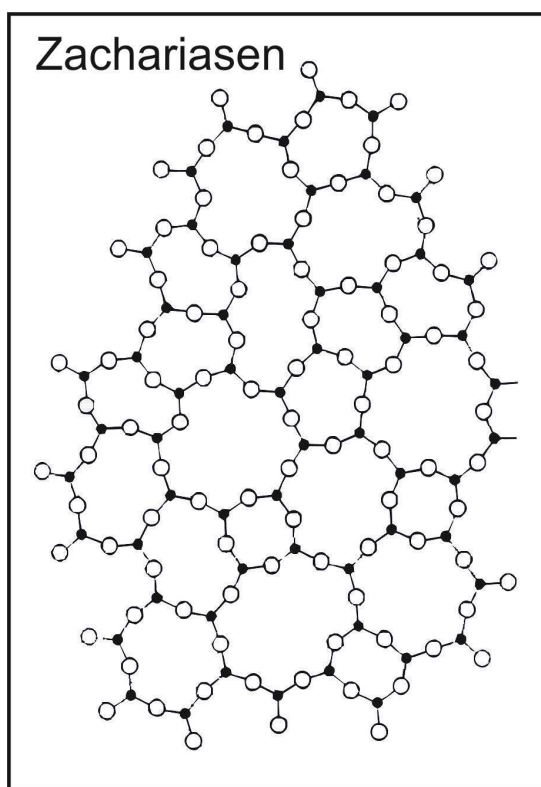
Reactions in Confined Space

Water Formation

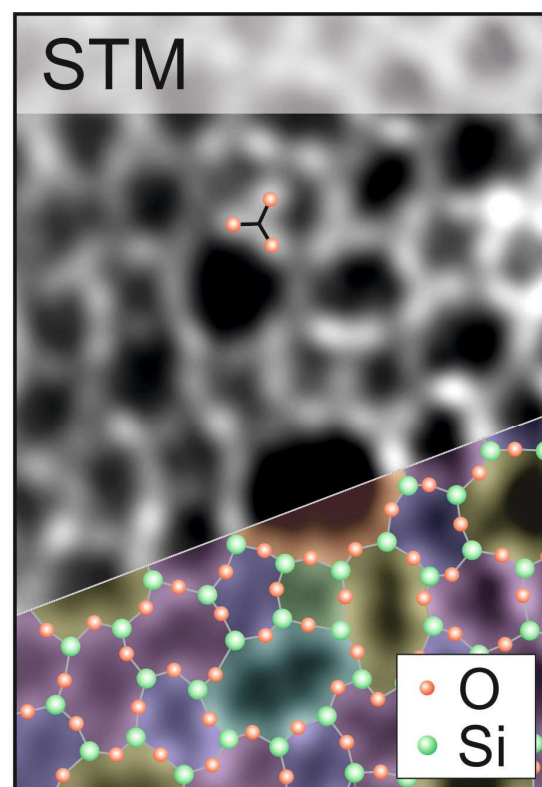
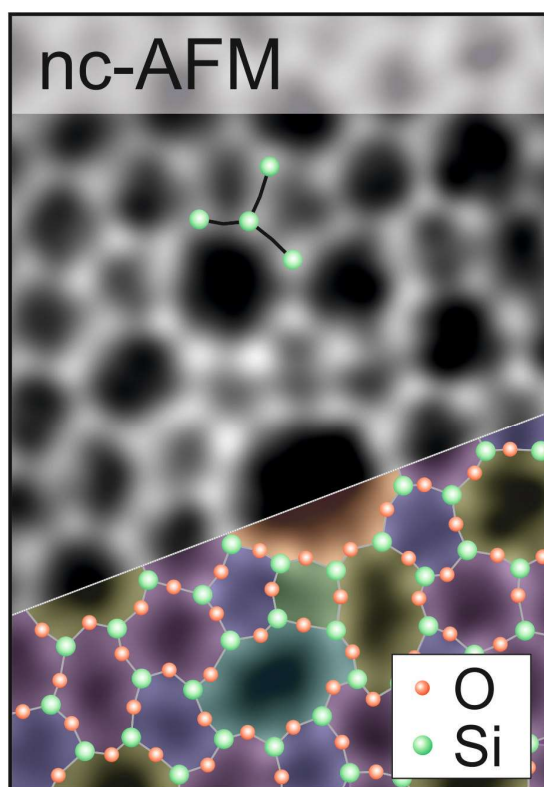


Scanning Probe: nc-AFM vs. STM

Simultaneous Imaging of Si and O

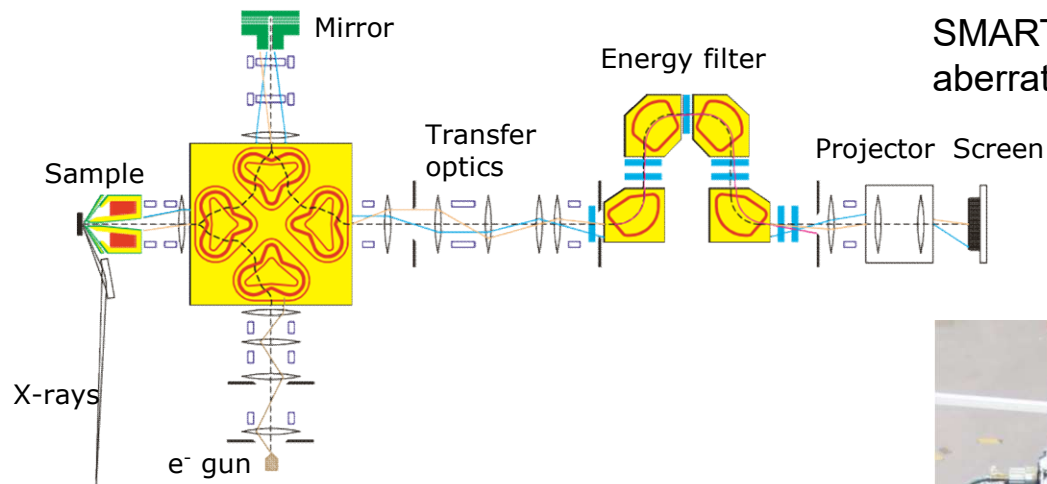


W.H.Zachariasen,
J.Am.Chem.Soc.;54, 3841 (1932)



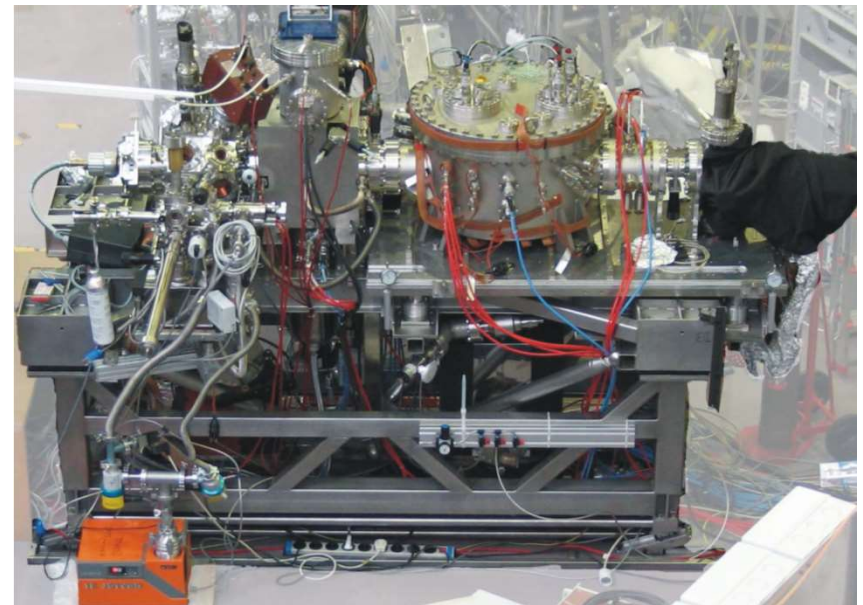
SMART

Experimental Setup



SMART: Spectro-microscope with aberration correction for many relevant techniques

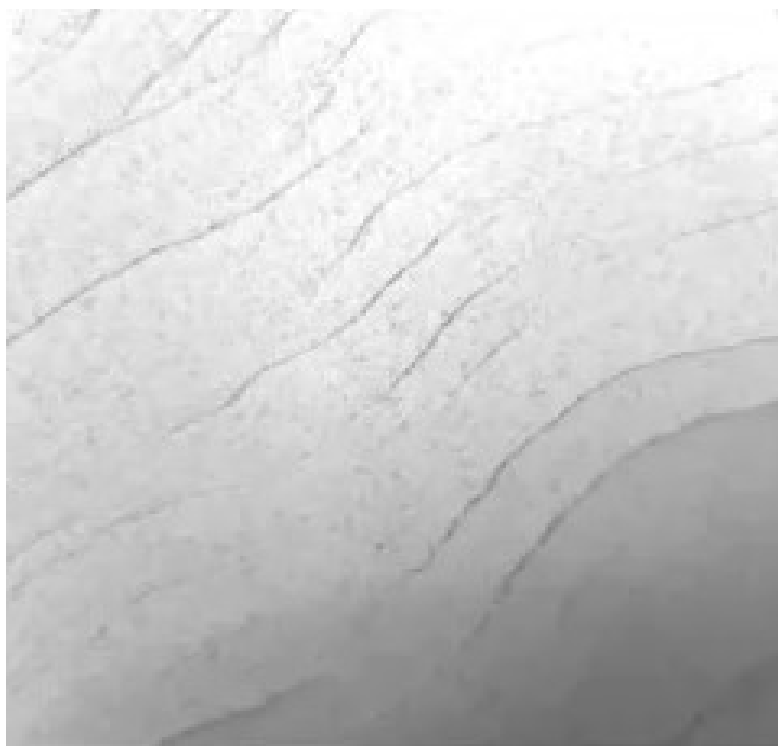
- Energy resolution: 180 meV
- Lateral resolution: 2.6 nm (LEEM), 18 nm (XPEEM)
- Temperature range: 100 ÷ 2000 K;
- Pressure range: 10^{-11} ÷ 10^{-5} mbar;
- Photon range: 80 ÷ 1500 eV
- surface sensitive
- temporal evolution
- multi-method: microscopy-diffraction-spectroscopy



Chemistry in confined space

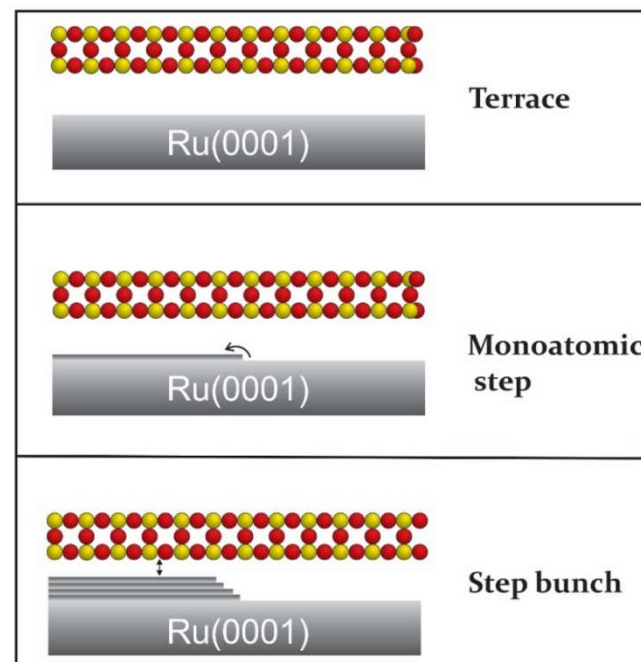
H₂ intercalation at closed Silica films: *real time* observation

Annealing @ 550 K in $p(\text{H}_2) = 1 \times 10^{-6}$ mbar



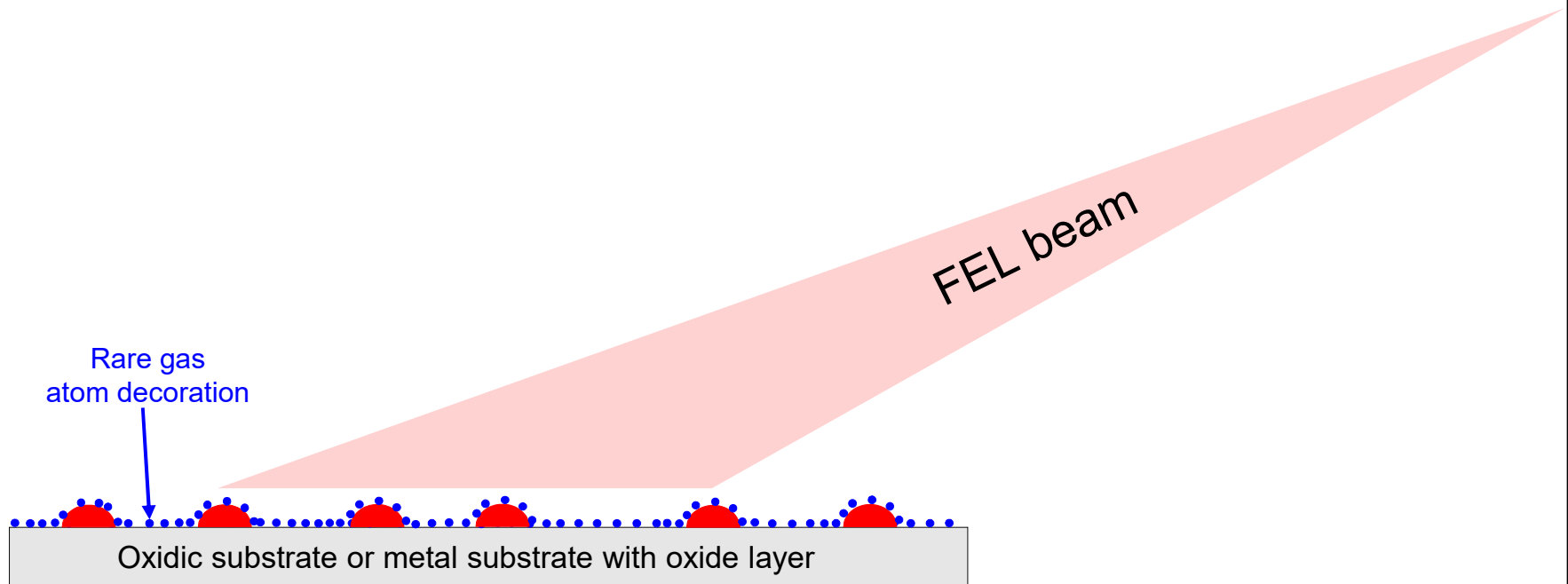
1 μm

Schwoebel barrier for diffusion



Messenger Atom Infrared Action Spectroscopy

Application to surfaces



Detection of

- Surface vibrational properties.
- Cluster vibrations -> cluster structure.
- Selective decoration may be used to study selected surface features.

Critical issue: quick diffusion of vibrational/thermal energy into the substrate.

➤ Only desorption by surface vibrations detectable: **high surface sensitivity**.