Voltage patterning of surfaces on the nanoscale

University of Aarhus

April 2009

Technical Field
Biotechnology
IT
Production technology

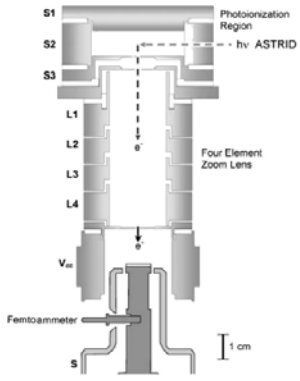
Business opportunity
- A research and development project with exclusive option on IP
- Licensing opportunity.

Current state of technology
Professor David Field has been granted 416.000 EUR in December 2008 from the Danish Natural Science Research Council (FNU) to further develop his research.

Applications
The invention has industrial uses in the micro-industry and in the rising nano-industry, where precise control of nanostructures is strongly needed. Moreover, the invention can be used for specialized lithography/patterning, alone, in combination with UV-lithography and e-beam lithography, and in general for micro- and nanofabrication.

Product advatages
The potential for voltage patterning is that it is possible to put down a pattern of N2O with a mask, remove the mask and then other molecules introduced would be attracted to where the N2O lies and be patterned accordingly.

The Technology
The experiment shows a spontaneous dipole alignment in N2O in multilayers on a substrate of gold.
The invention is based on a technique for converting a mechanical mask into a voltage mask using a film of nitrous oxide, by which (voltage) functionalization of a gold surface is achieved whereby for instance biomolecules, such as aminoacids and DNA bases, can be deposited in a desired pattern according to the mechanical mask used.
By firing a high resolution electron beam using currents of typically 200 fA, the result is a current measured by using a femtoammeter. This shows that the N2O spontaneously acquire a positive charge. The very low currents used interfere negligibly with the dipole alignment. A special thickness of the film is necessary though. Once reached a certain thickness, the voltage begins increasing with the film thickness. The phenomenon also shows strong temperature dependence.



Intellectual Property Rights
The Intellectual Property Rights are owned by the University of Aarhus. A priority application was filed 13 January 2009.

AARHUS UNIVERSITET

Inventors

Dr. **David Field** is a professor at the Department of Physics and Astronomy, Aarhus University. One of his main research areas is cold electron scattering. Dr. Field received his D.Sc. in chemistry from the University of Cambridge in 1999 and is the author of ~180 publications in the fields of molecular physics and astronomy.

Dr. **Nykola Clare Jones** is an assistant research professor at the Department of Physics and Astronomy, Aarhus University. Her main research areas are low energy electron interactions with molecules in gaseous or solid phases as well as molecular electronic state spectroscopy of molecules of atmospheric and biological interest. Dr. Jones received her PhD from the University of London in 2000. Since then she has been working at Aarhus University. She has published more than 30 peer reviewed papers.

Investors also include former group members **Richard Balog**, PhD and **Peter Cicman**, PhD.

References

A: Field, D., Jones, N., Ziesel, J.P., Cold encounters: Electrons and molecules, Europhysics News, Nov/Dec. 2002

B: Hoffmann, S., Lunt, S., Jones, N., Field, D., Ziesel, J.P., An undulator-based spherical granting monochromator beamline for low energy electron-molecule scattering experiments, Review of Scientific Instruments, volume 73, number 12, Dec. 2002

C: Balog, R., Cicman, P., Jones, N.C., Field, D., Spontaneous Dipole alignment in Films of N_2O, Physical Review Letters, RPL 102, 073003 (2009), 20th February 2009

Contactperson:

AARHUS UNIVERSITET

Kristine Kjer Hansen
University of Aarhus
Phone: + 45 8942 6864
E-mail: kkh@adm.au.dk