TECHNISCHE UNIVERSITÄT DRESDEN

namlab nanoelectronic materials laboratory

complex nano materials

Fakultät für Maschinenwesen Institut für Werkstoffwissenschaft, Professur Materialwissenschaft und Nanotechnik

Silicon to Nickel-Silicide Nanowire Heterostructures for Bio-FETs

Sebastian Pregl, Dr. Walter Weber, Dr. Jörg Opitz and Prof. Gianaurelio Cuniberti
— Institute for Materials Science and Max Bergmann Center of Biomaterials, Dresden University of Technology
— NaMLab GmbH Dresden

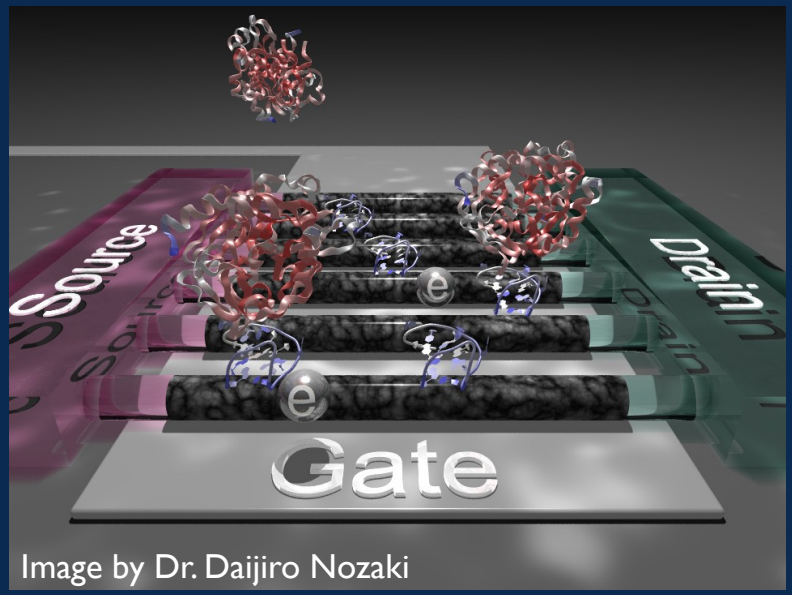
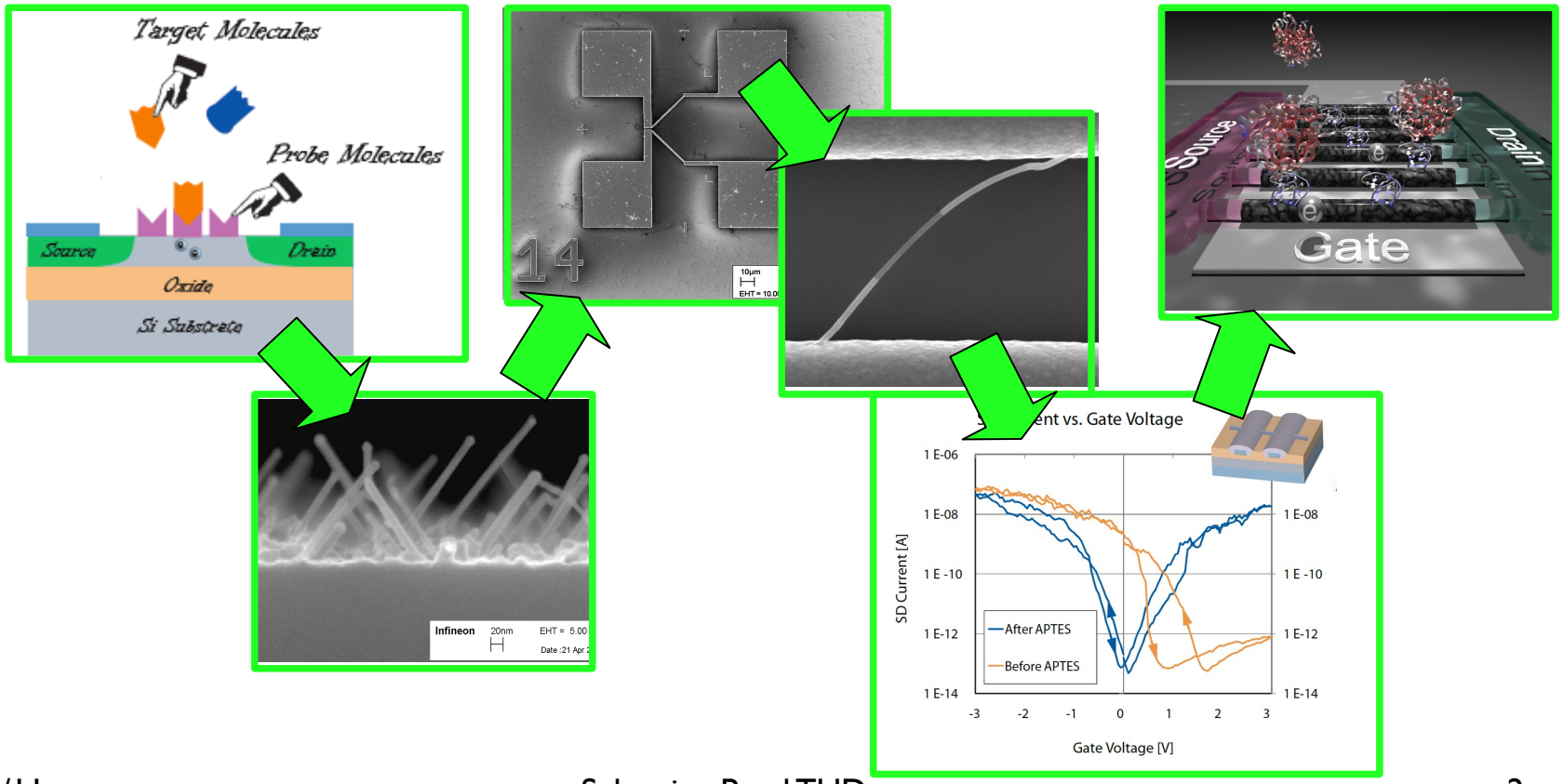


Image by Dr. Daijiro Nozaki

DRESDEN 14.3.2011

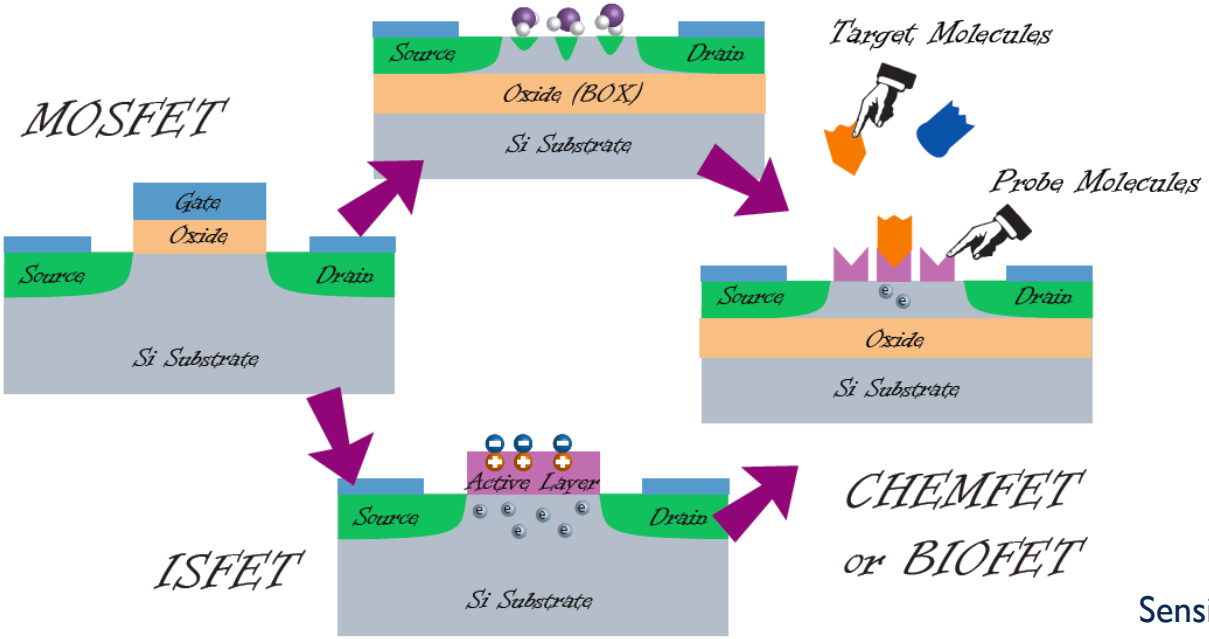
Outlook for today's talk

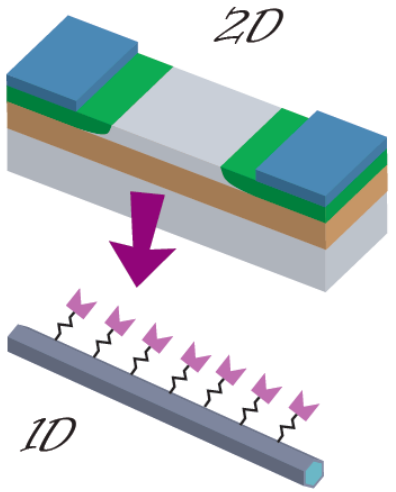
Si/NiSi2-FETs (field effect transistors) as sensors



Real time chemical sensors in 2D and 1D

Field effect and charge transfer leads to change in current





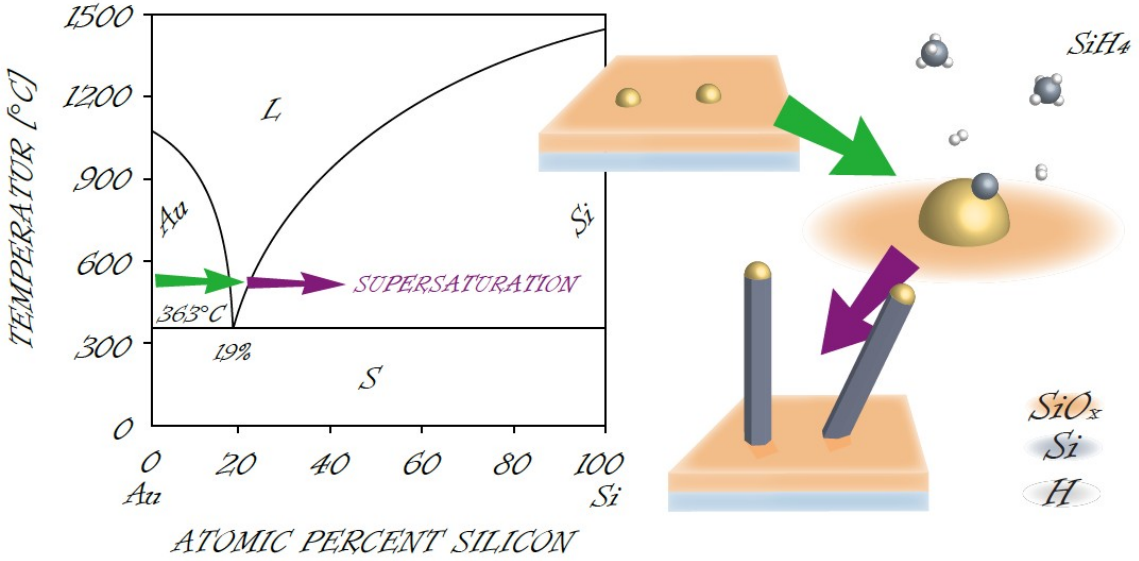
Sensing is a surface effect =>

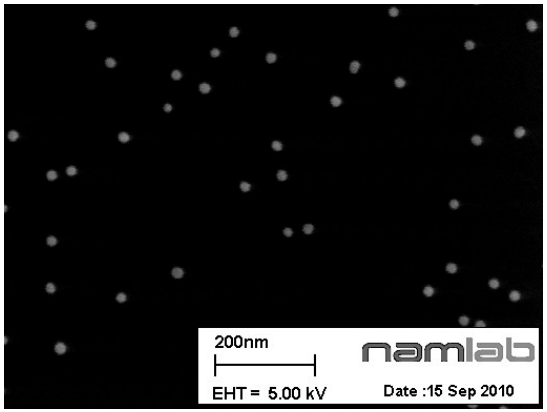
Enhancement of surface/volume ratio

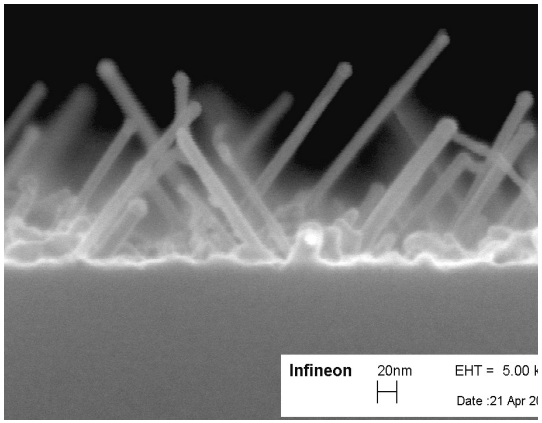
Sensitivity down to single molecule detection

Growth of silicon nanowires

VLS (vapor liquid solid) growth in CVD furnace



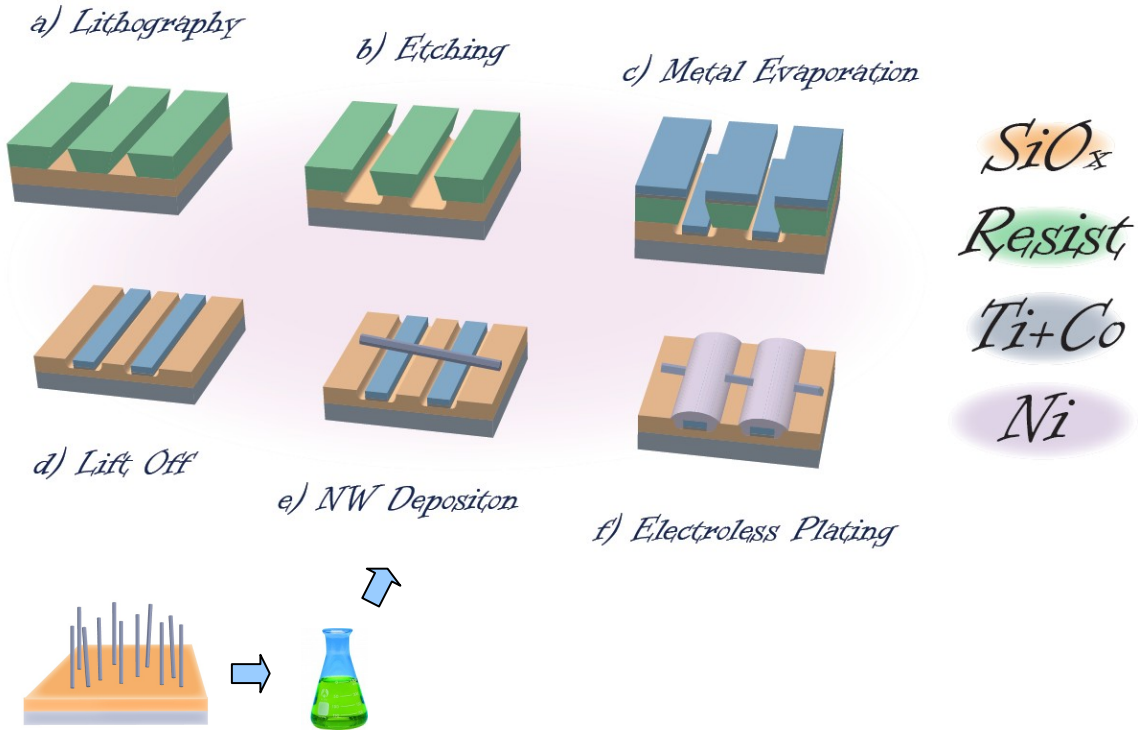




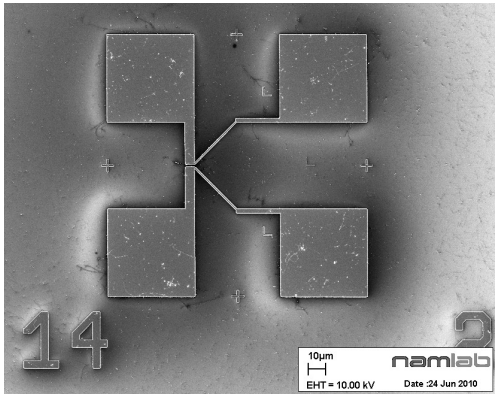
Weber, W.; Duesberg G.S. et al. *Phys. Stat. Sol. C. IWEPNM 2006 Proc.*

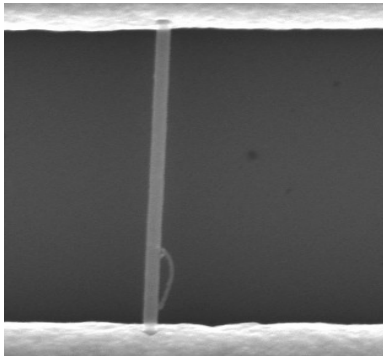
Creation of Si/NiSi2-FETs

Integration of bottom up nanowires in top down structures



sonication

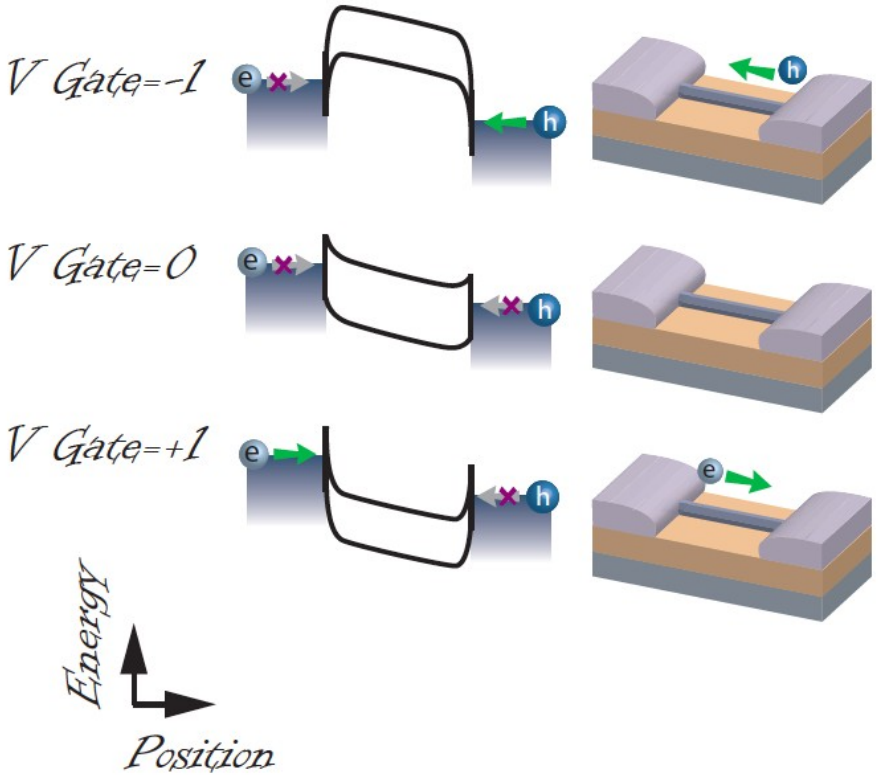


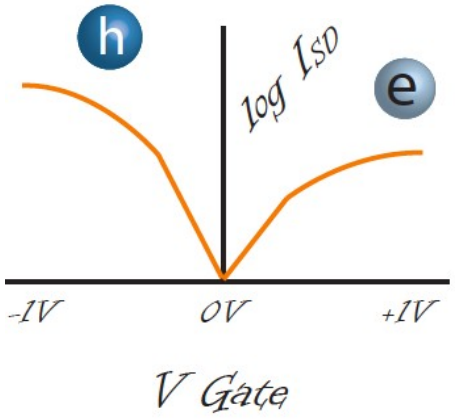


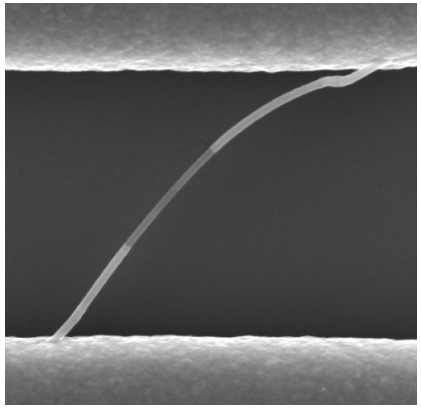
After electroless Nickel deposition

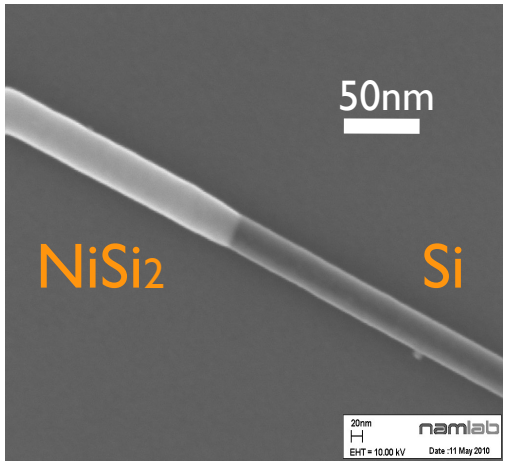
Measurements of Si/NiSi2-FETs

Schottky-Barriers lead to rectified charge carrier transport



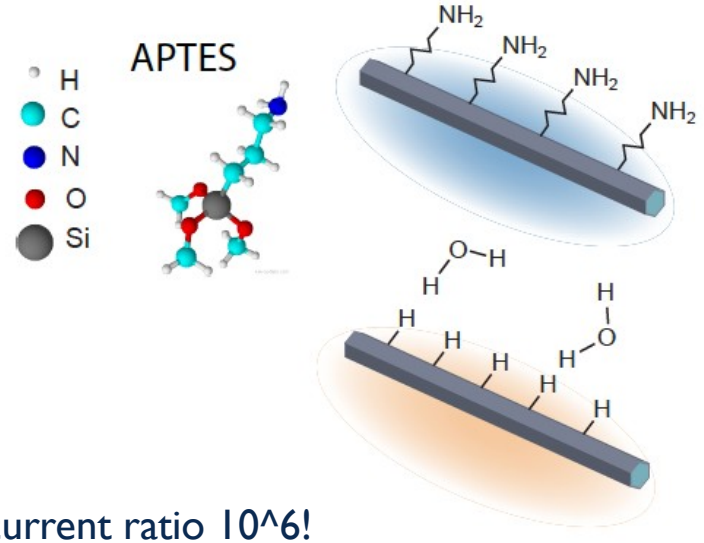


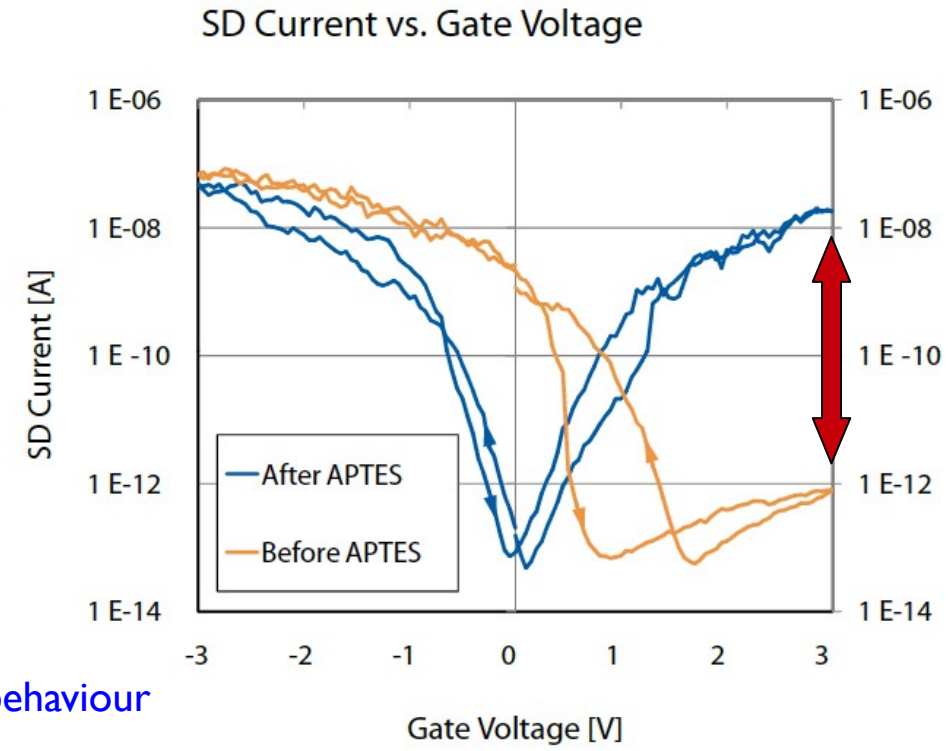




Results: Measurements of Si/NiSi2-FETs

Surface functionalization changes rectifing behaviour





On/off current ratio 10^6!

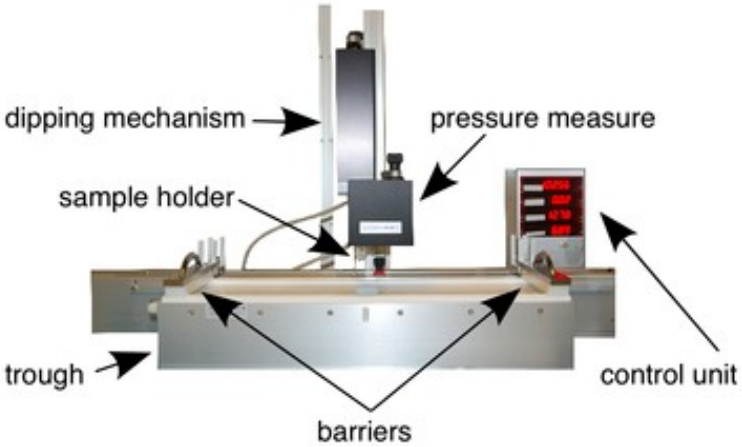
H-terminated SiNWs akt as p-type unipolar FETs

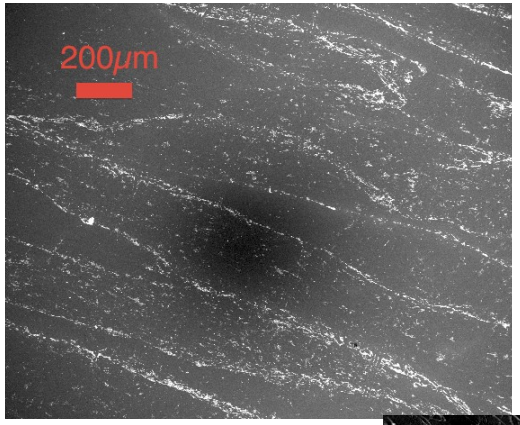
Hydrocarbon terminated NWs show ambipolar behaviour

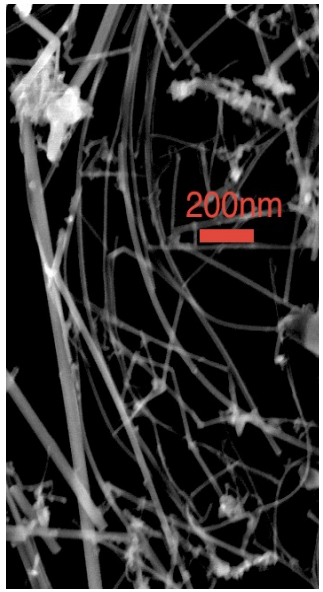
Change in currents between uni-ambipolar 4 orders of magnitude!

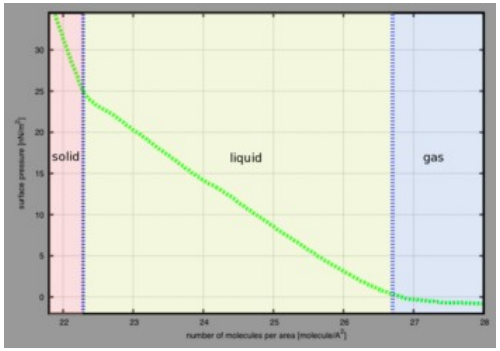
Results: Parallel arrays of Si/NiSi2-FETs

Langmuir-Blodget technique for assembly

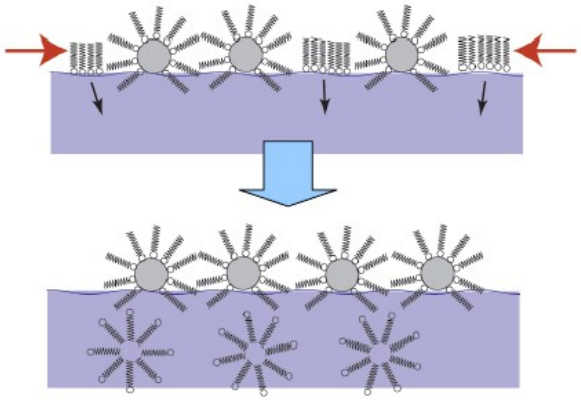


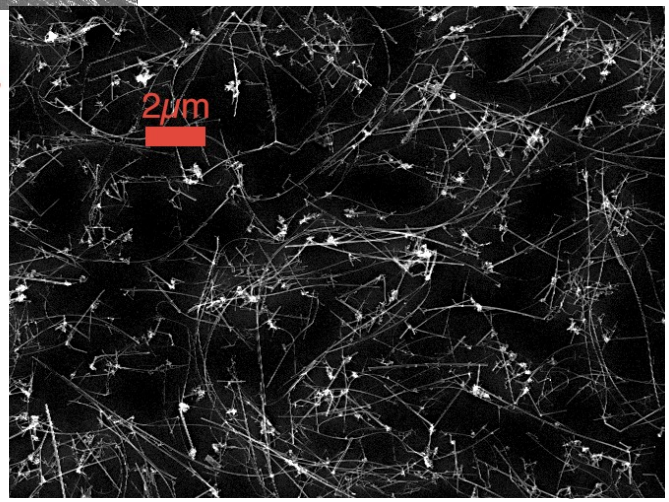






Picture by Markus Gellesch

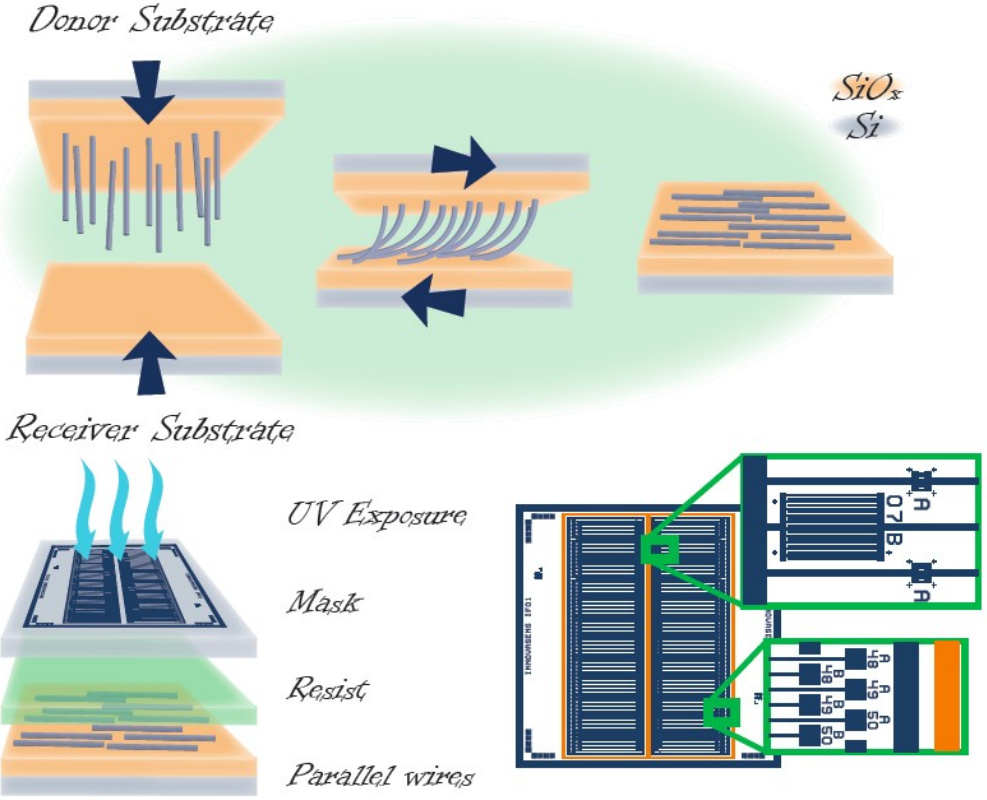


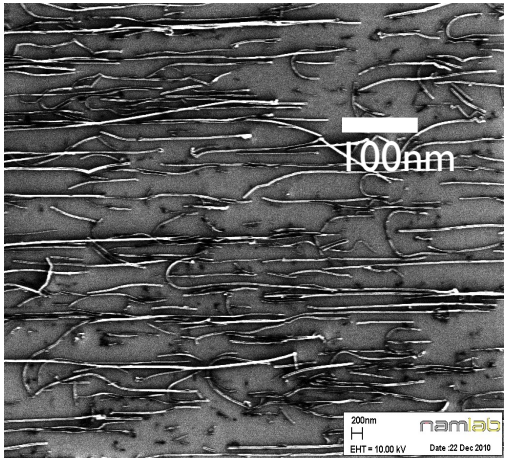


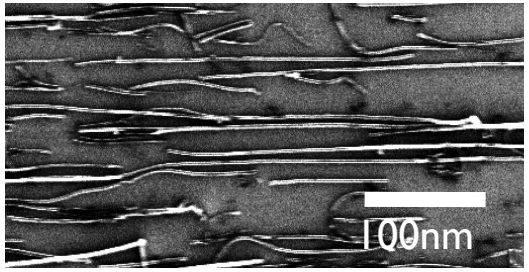
Sebastian Pregl TUD

Results: Parallel arrays of Si/NiSi2-FETs

Parallel assembly of nanowires by contact printing







TECHNISCHE UNIVERSITÄT DRESDEN

namlab nanoelectronic materials laboratory

complex nano materials

Thank you for your attention!

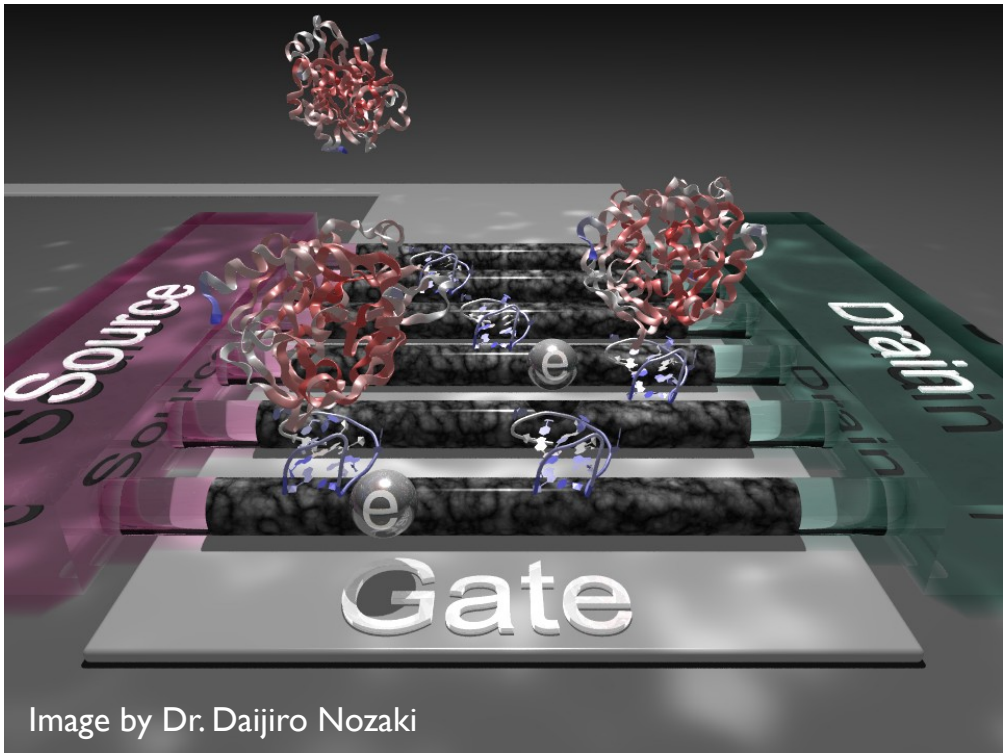


Image by Dr. Daijiro Nozaki

SACHSEN

Europa fördert Sachsen.
ESF
Europäischer Sozialfonds

Finanziert aus Mitteln der Europäischen Union und des Freistaates Sachen