

Relevant issues for a Nanofactory project

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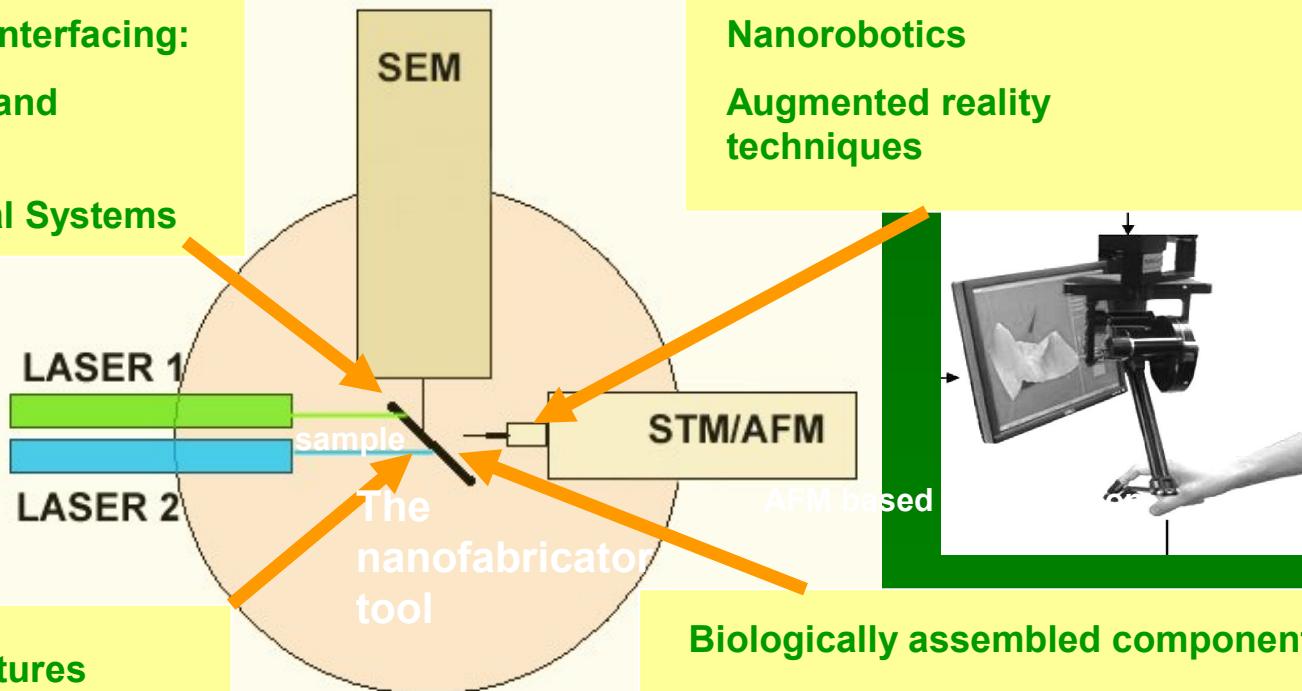
A block scheme of the “Nanofactory”

Microtechnologies for interfacing:

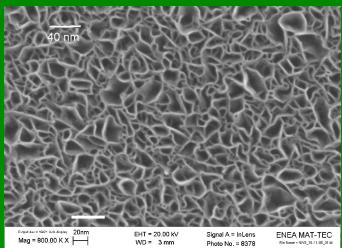
Lithography for wiring and padding

MicroElectroMechanical Systems

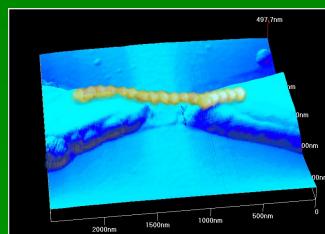
Microfluidics



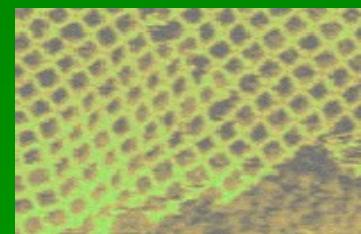
CNT spring based switch



Vertically aligned carbon nanowalls



A potato virus across nanoelectrodes?



DNA grids as bioelectronic mother-boards?

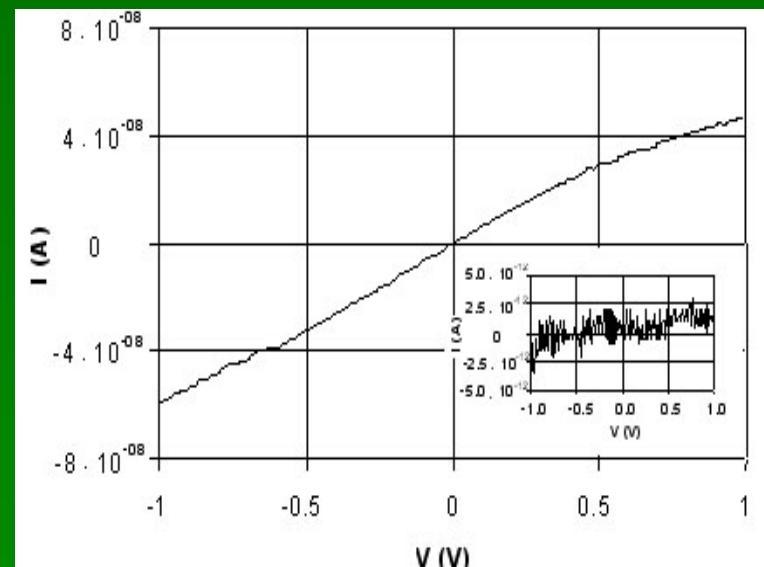
Positioning a CNT bundle accross nanoelectrodes (LASMEDS project 1997-2000)

SEM

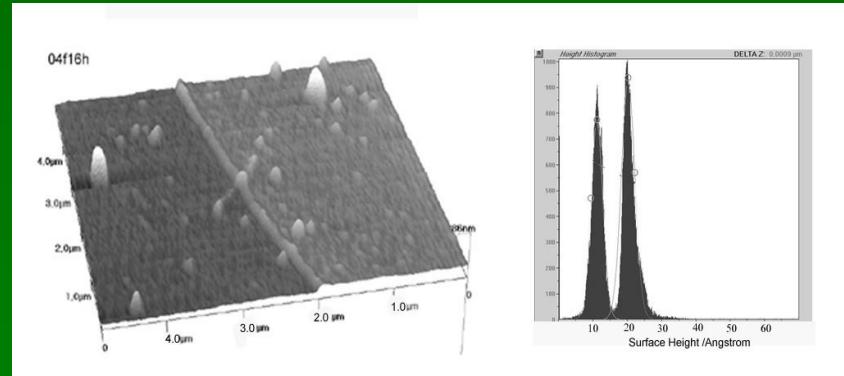
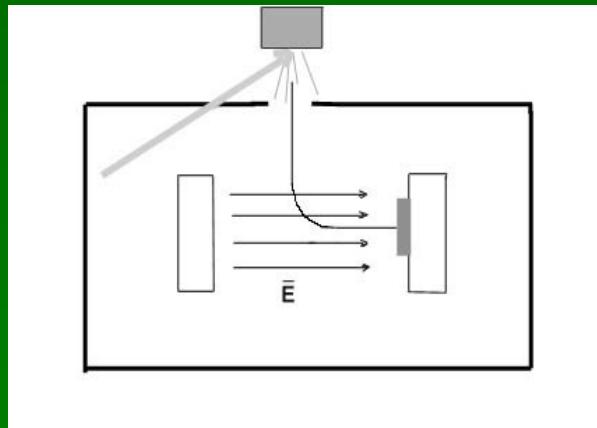


CNT bundle

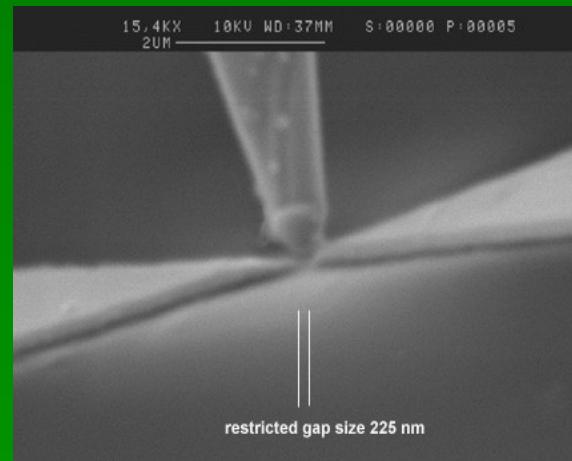
Gold nanoelectrodes on silicon
nitride



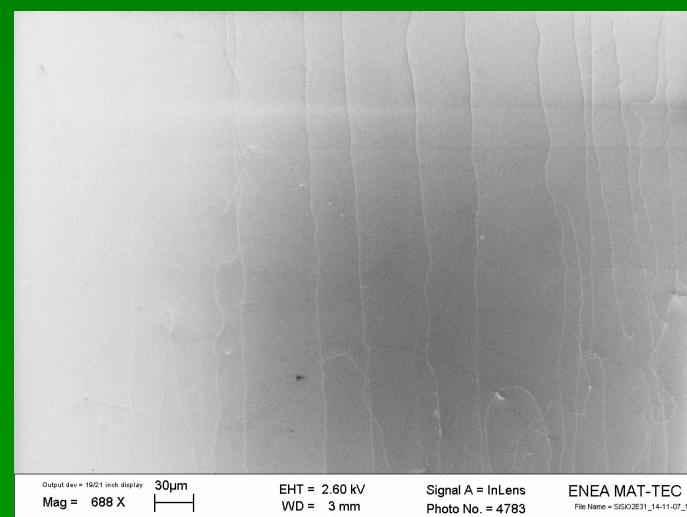
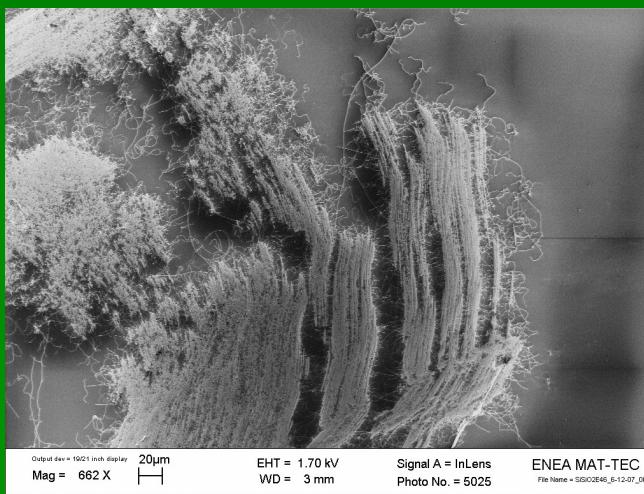
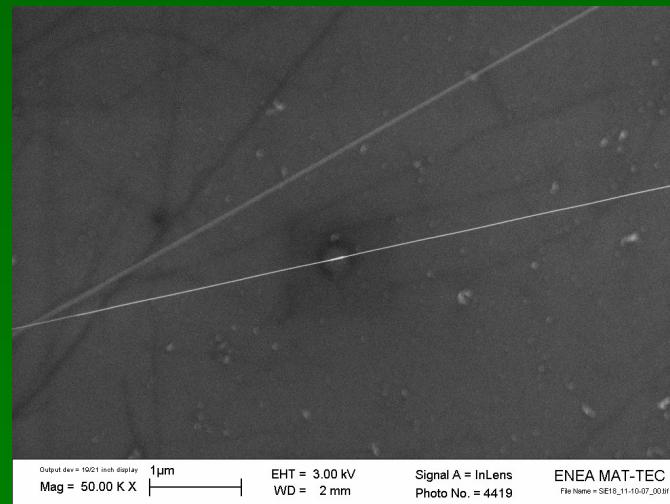
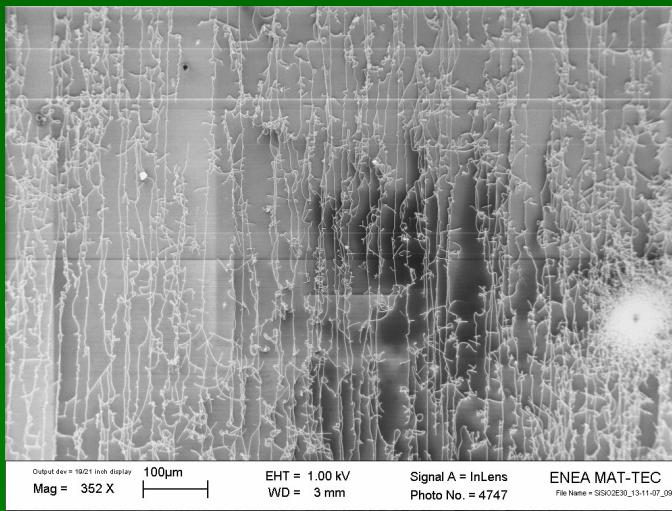
Improving nanoelectrodes: thin, uniform and narrow gap films



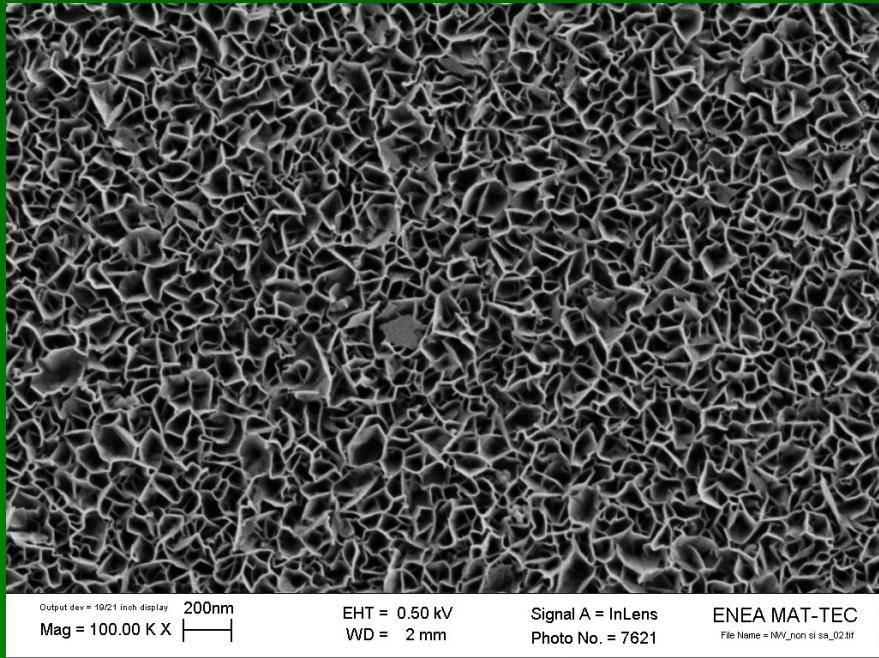
9 Angstrom thick



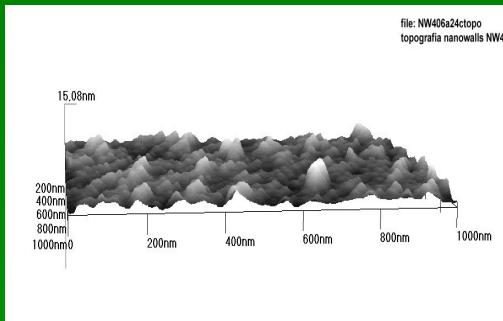
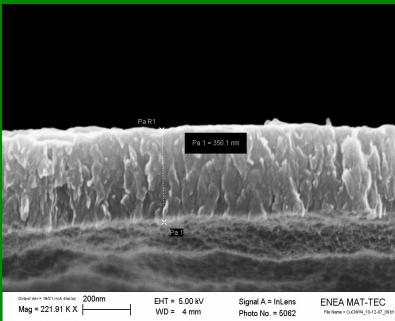
CVD growth of clean and straight CNTs



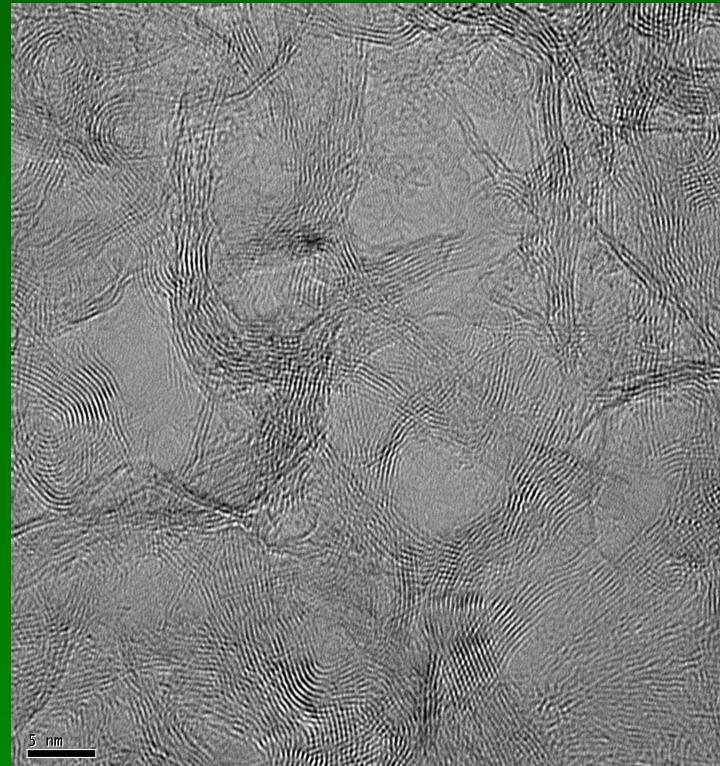
CVD growth of carbon “nanowalls”



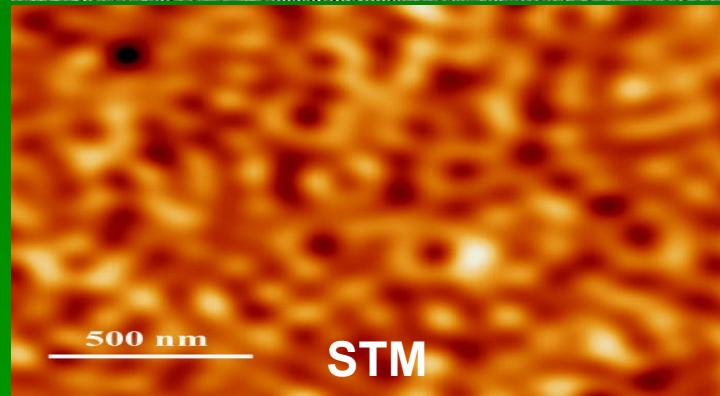
SEM



AFM

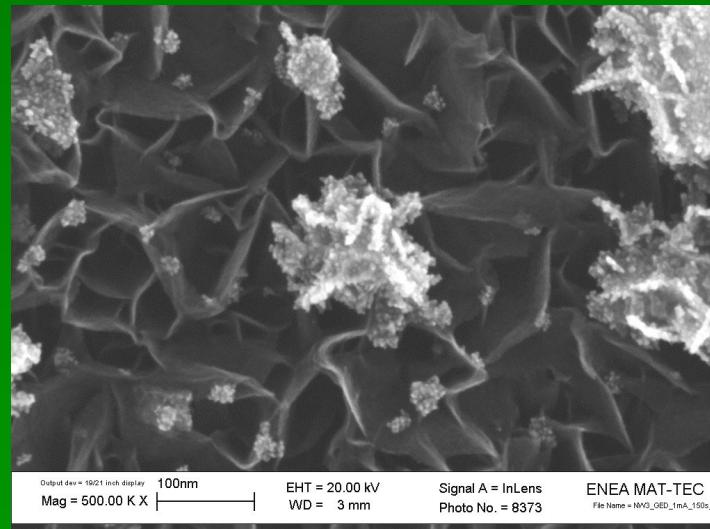
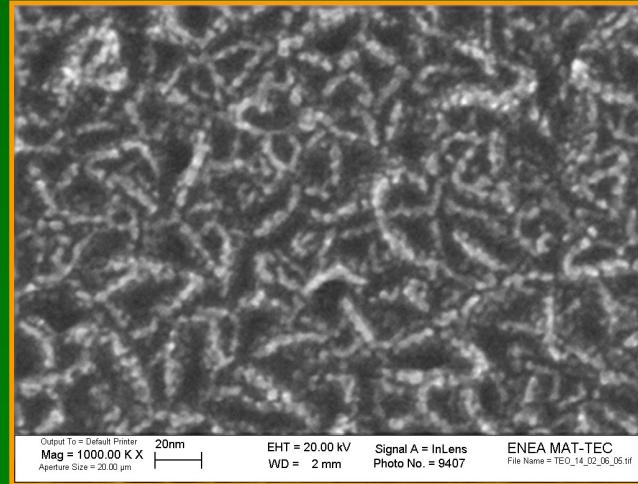
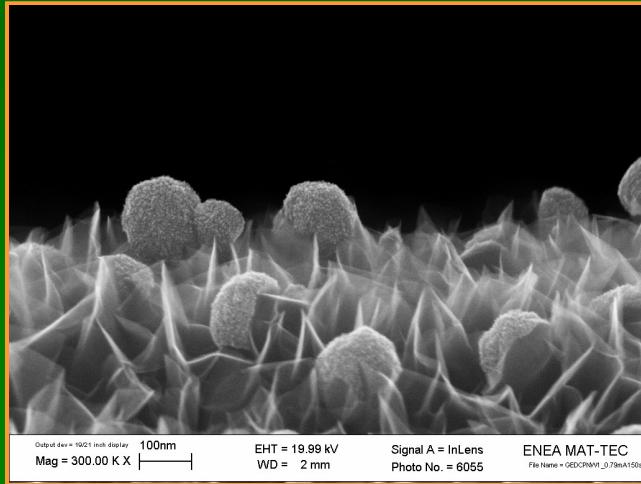


TEM

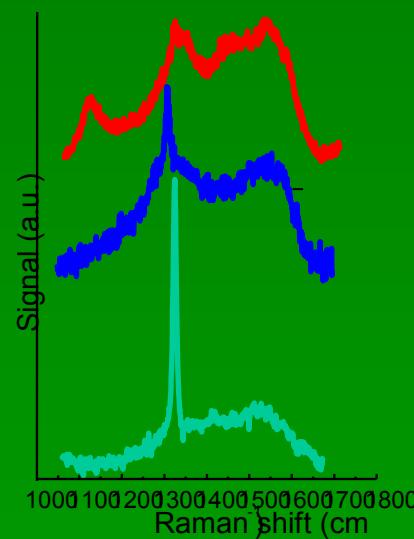
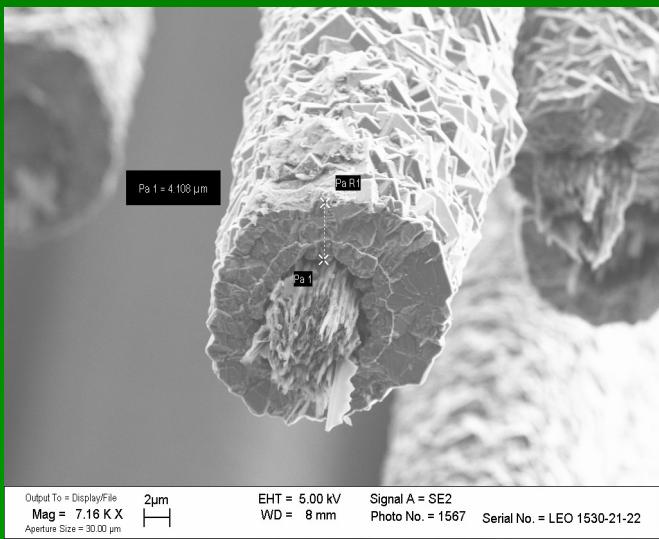
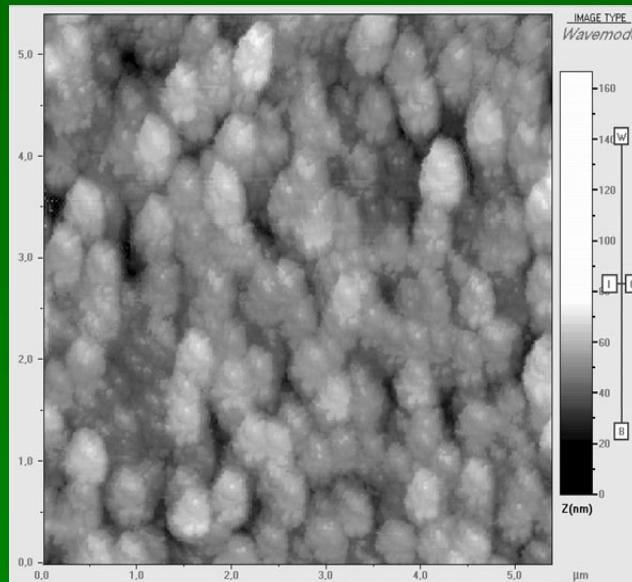
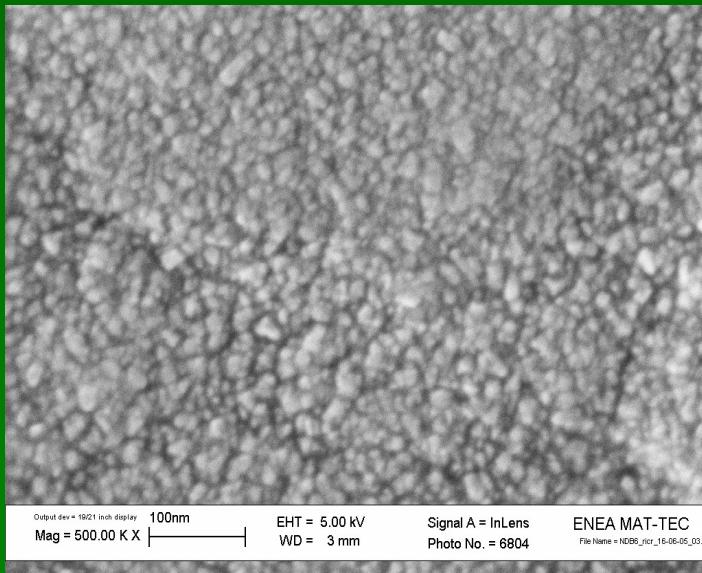


STM

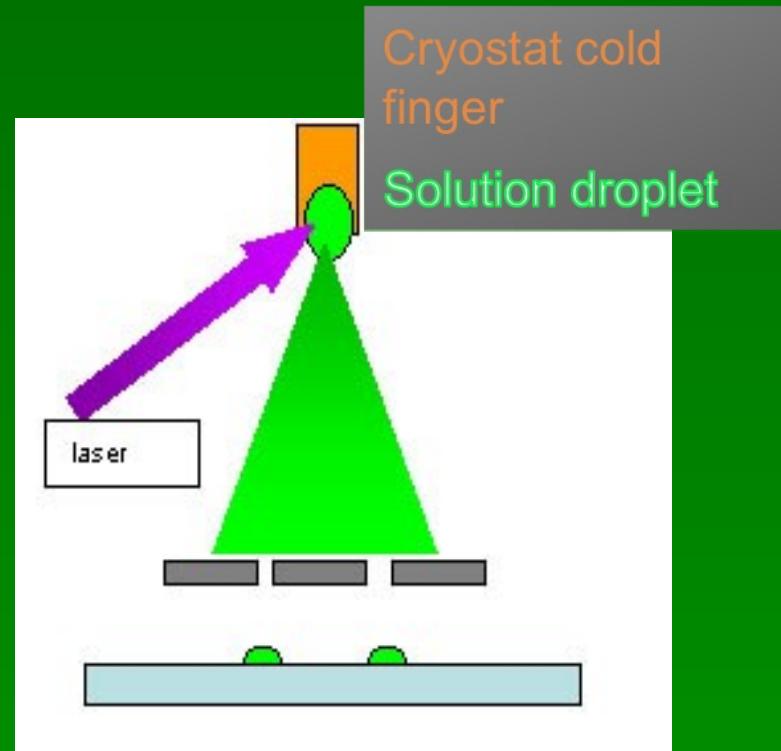
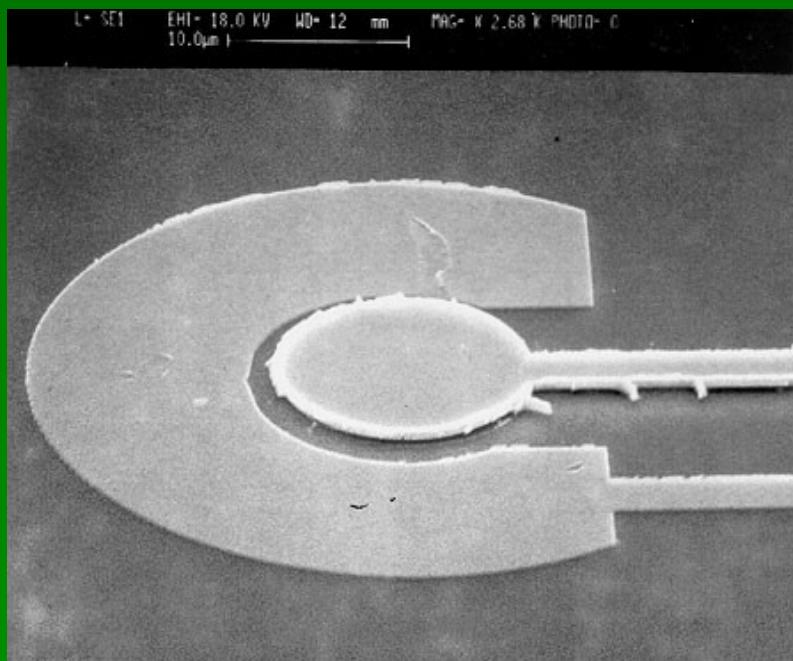
Pt catalysts on C-nanowalls for fuel cells



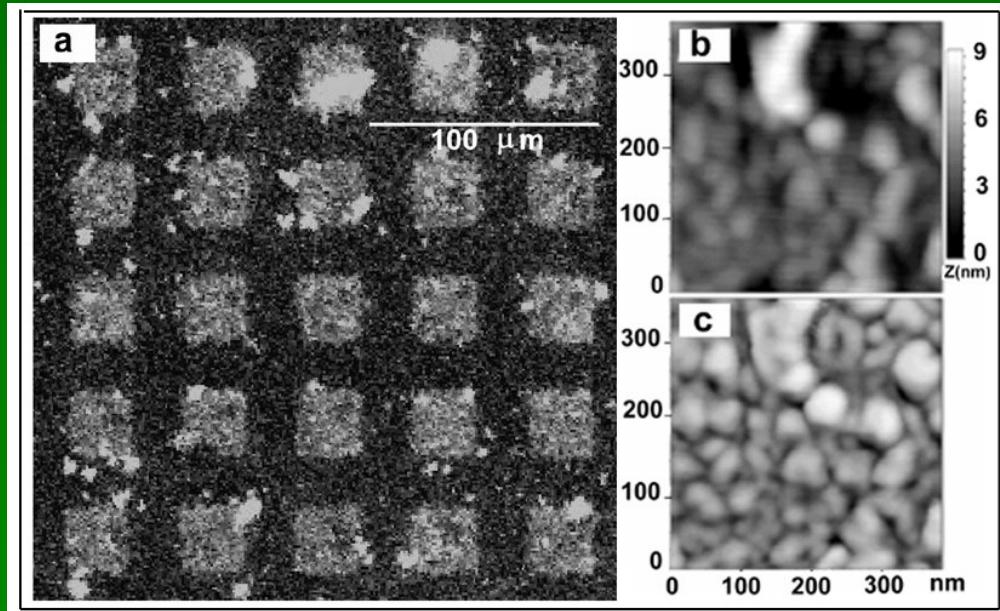
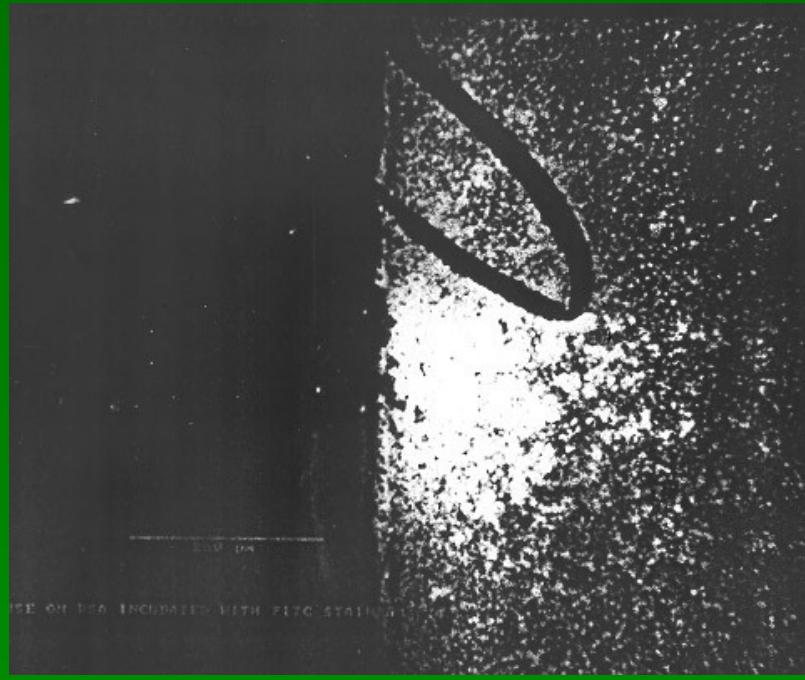
CVD growth of micro- and nanodiamond



The smallest biosensor in the world (1995) built by e-beam lithography and pulsed laser deposition of glucose oxidase



Fluorescence from antigens reacting with patterns of laser deposited antibodies

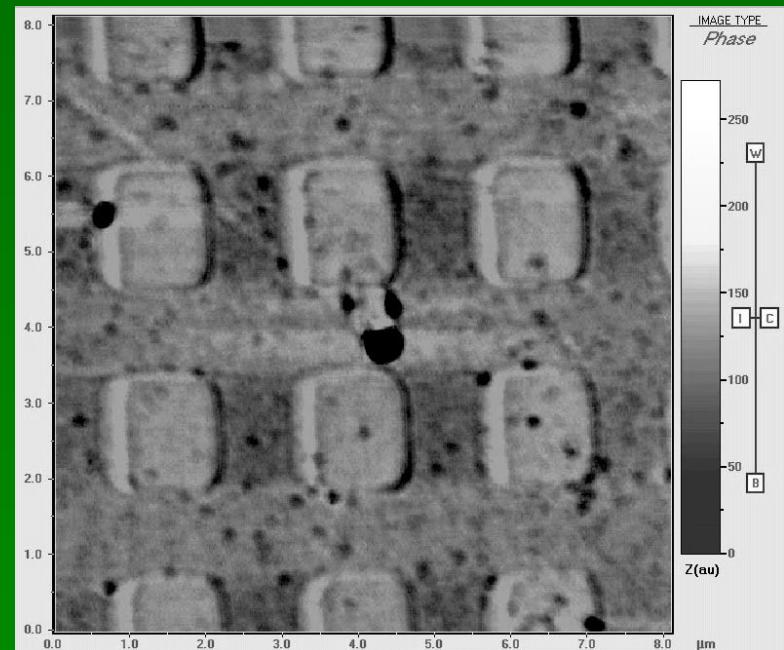
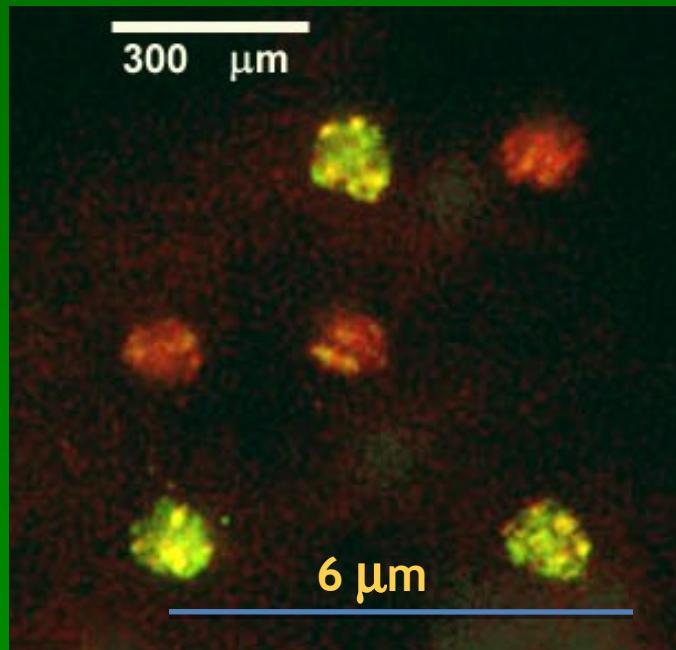


Bovine Serum Albumine BSA + laser deposited IgG + (anti-Ig)/FITC

Laser excited fluorescence from anti IgG mouse/ Alexafluor 488 incubated on micropatterned IgG mouse, confocal microscopy

AFM topography (b) and phase contrast (c) of details of IgG mouse layer

High resolution, laser based patterning of biomolecules

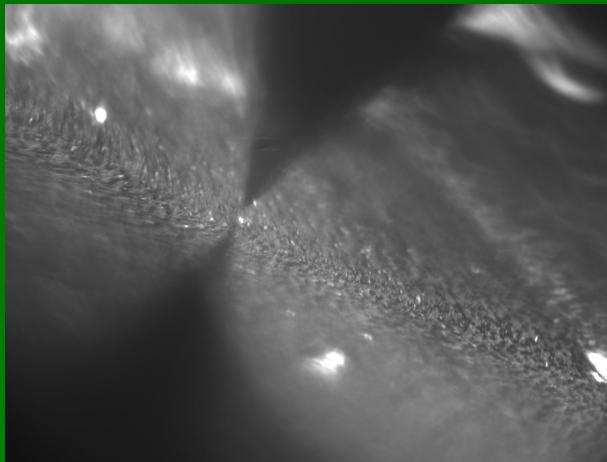


- reactive immunoglobulines (AFM)

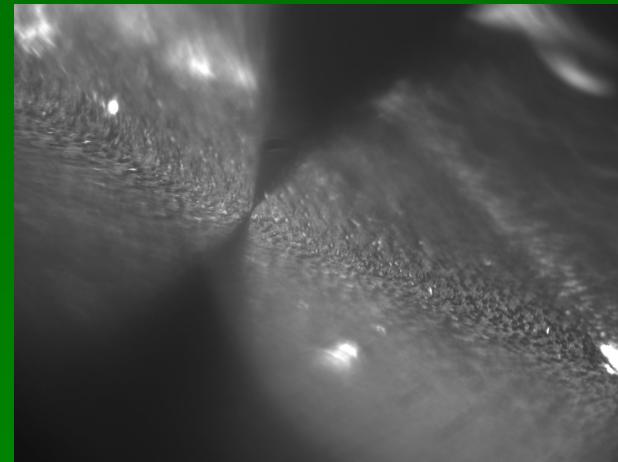
Horseradish peroxidase

“Tip enhanced” fluorescence

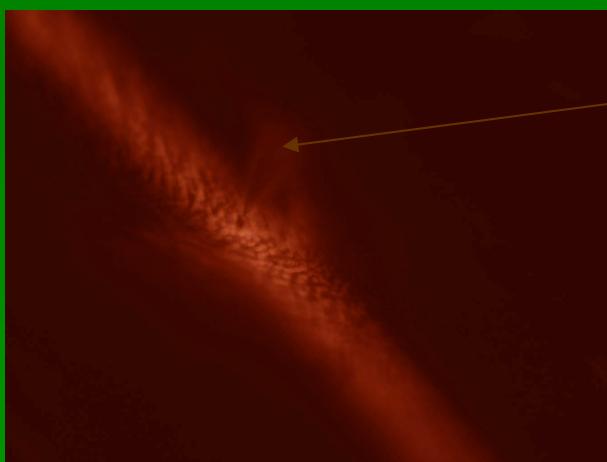
Tip away from surface



Tip close to surface

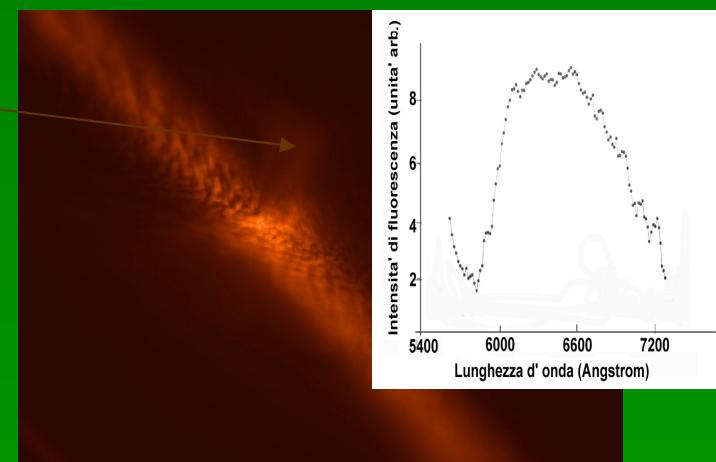


Laser off

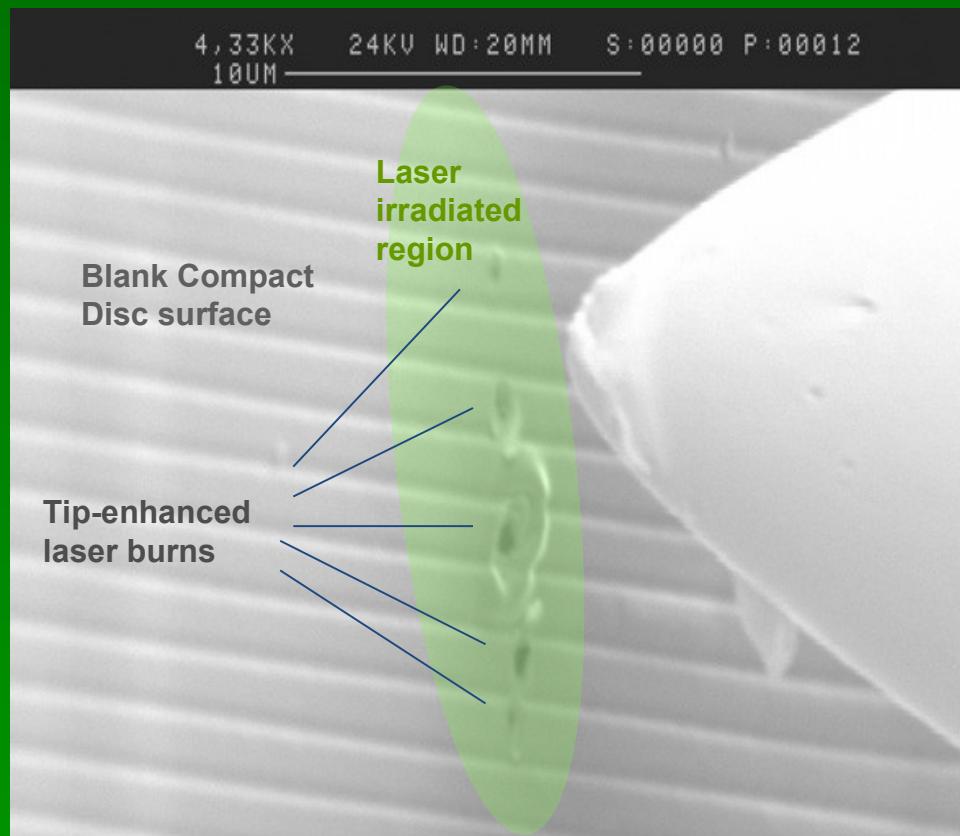


Tip

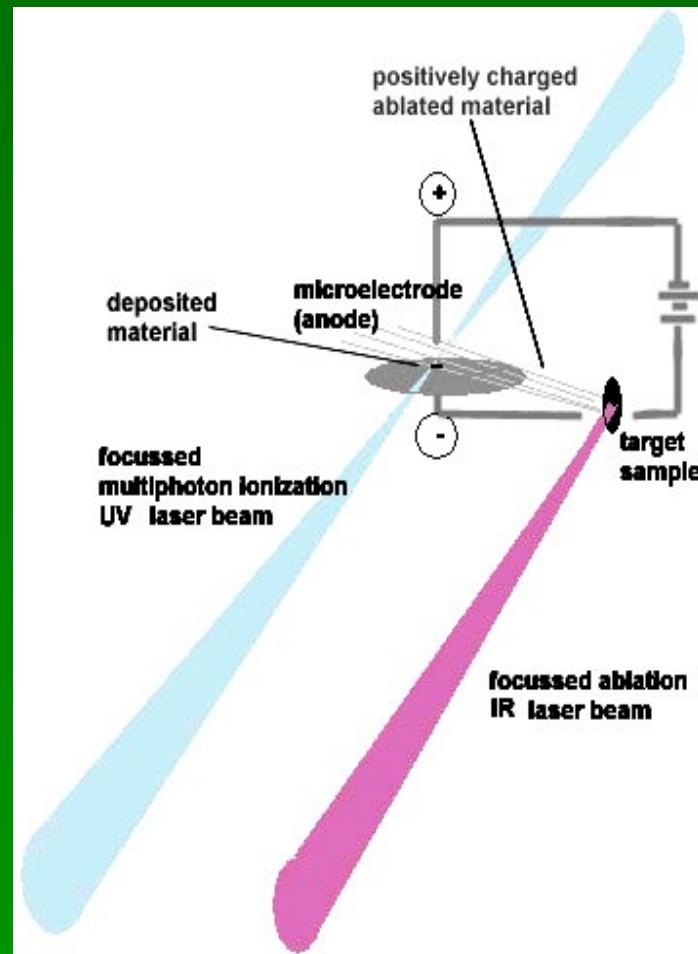
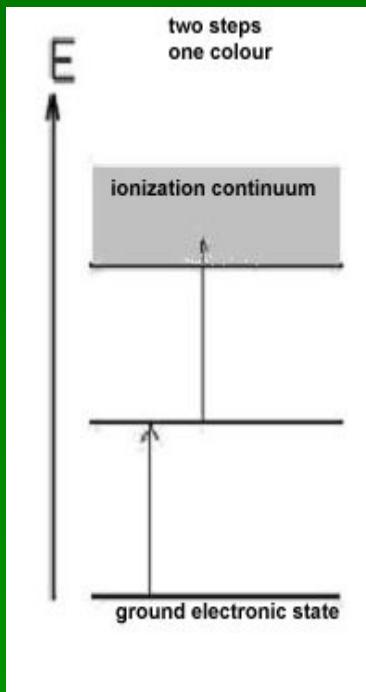
Laser on



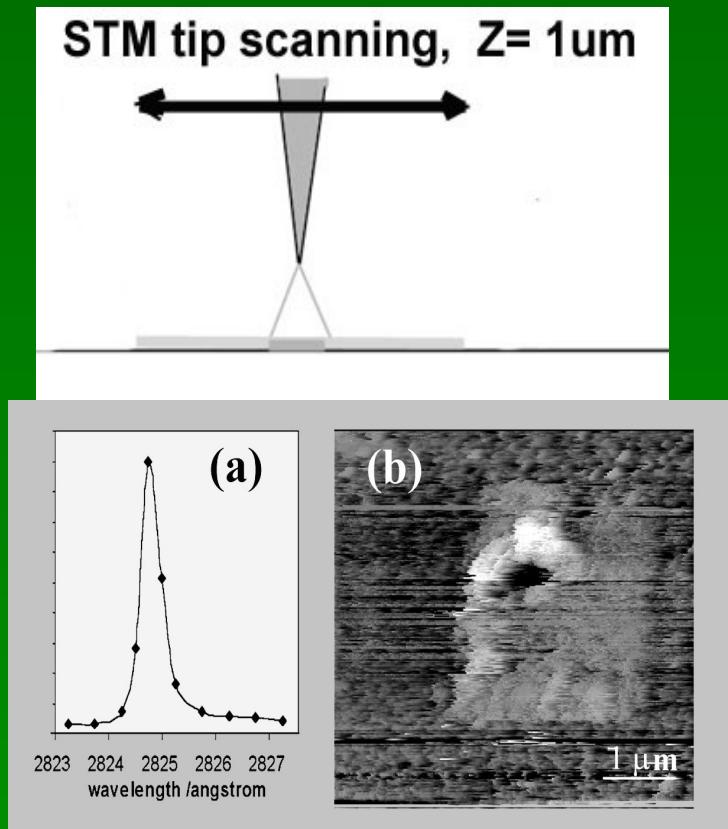
“Tip enhanced” structuring: burning nanoholes in a CD with a mildly focussed laser beam



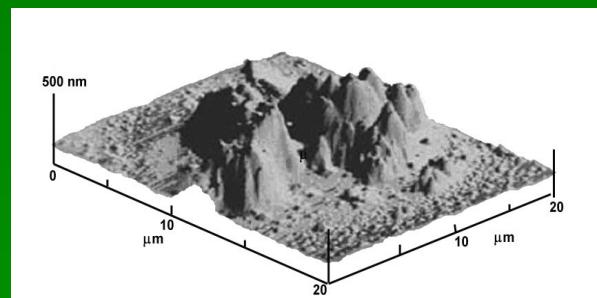
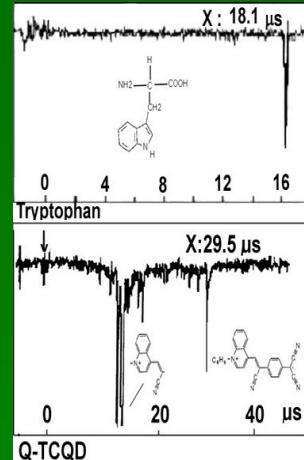
Ablation / 2photon ionization direct writing: concept



Ablation / 2photon ionization direct writing: “tip enhanced” experiments

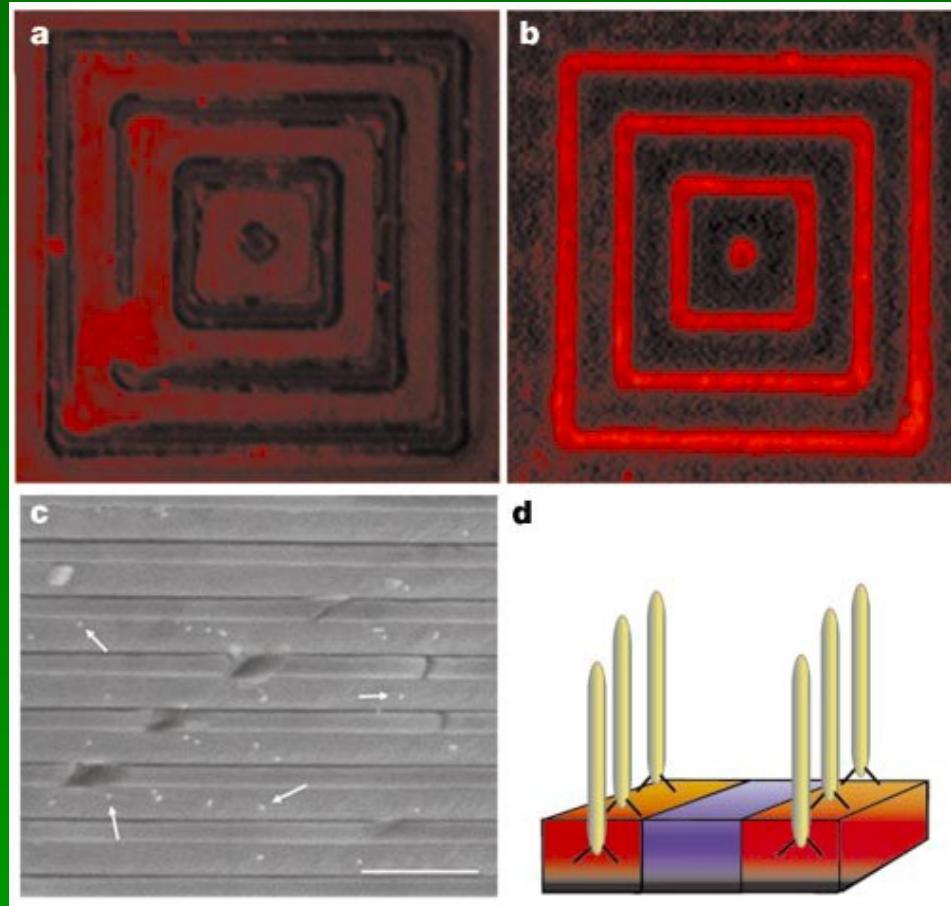


“nanopainting” atomic lead on gold



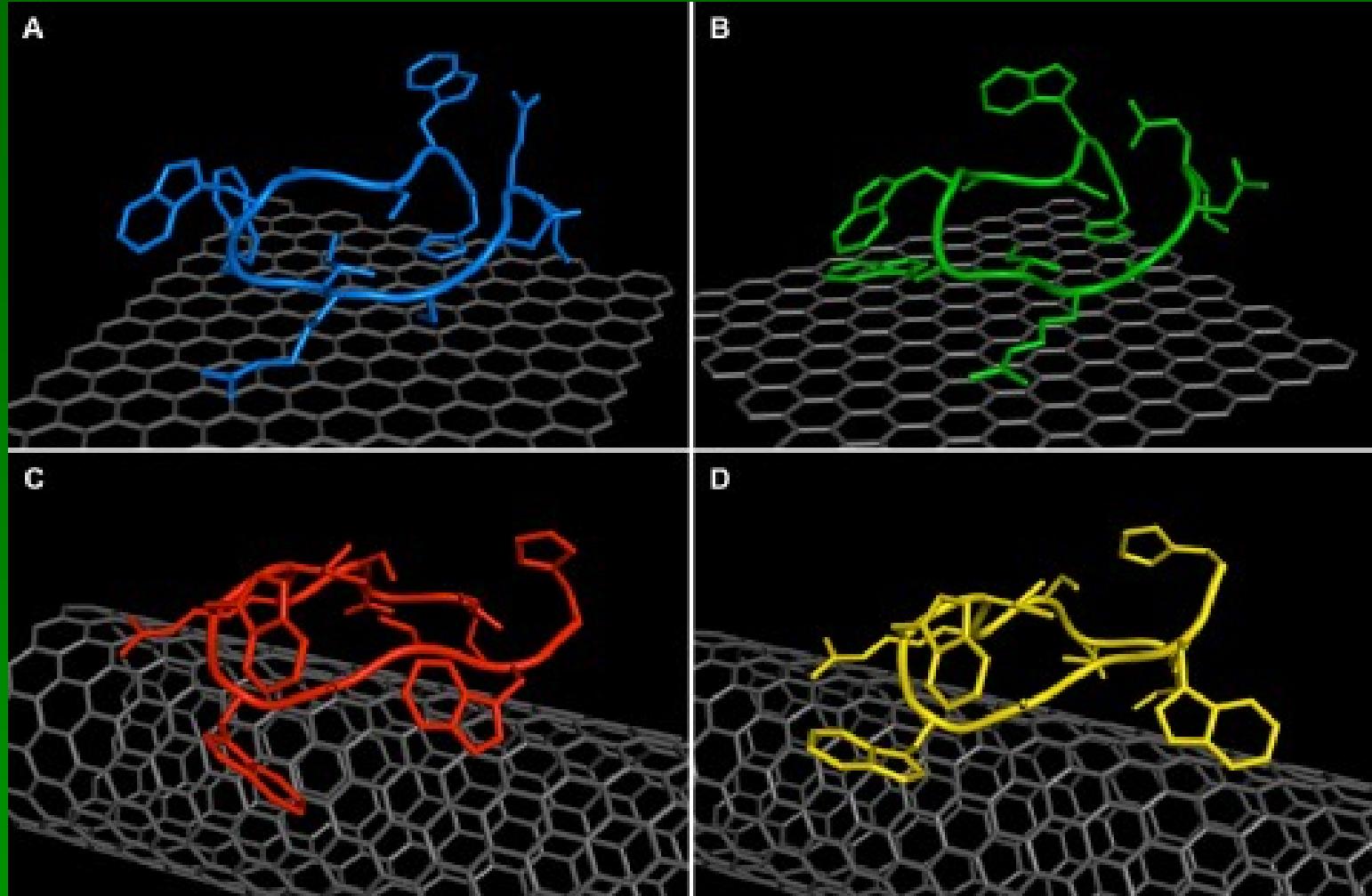
Depositing localized
tryptophan clusters

Selective peptides for Gallium Arsenide by phage display techniques



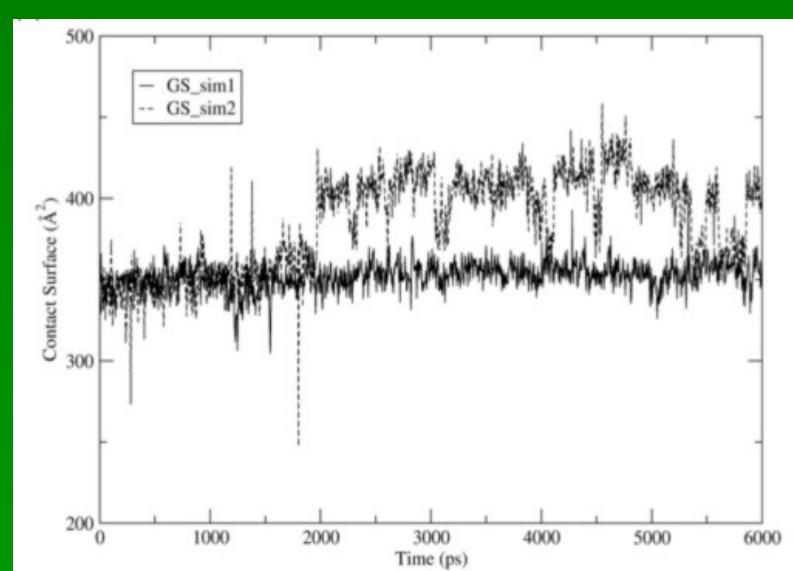
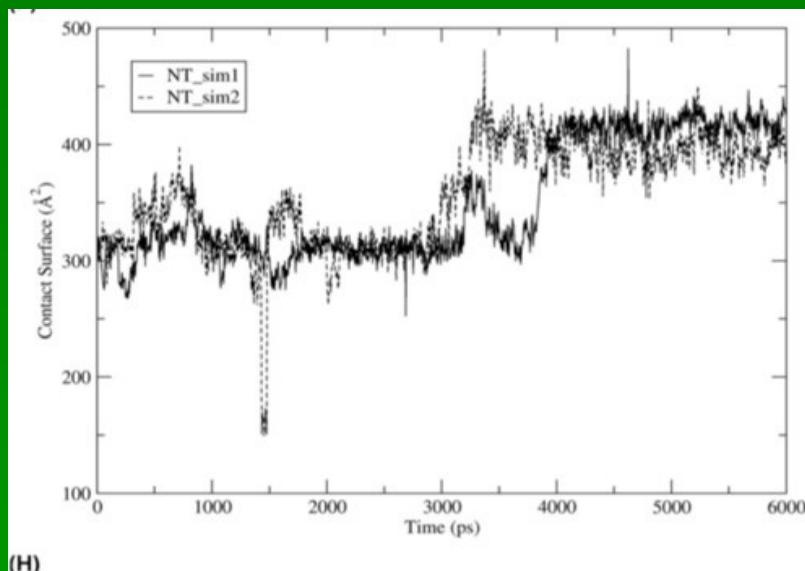
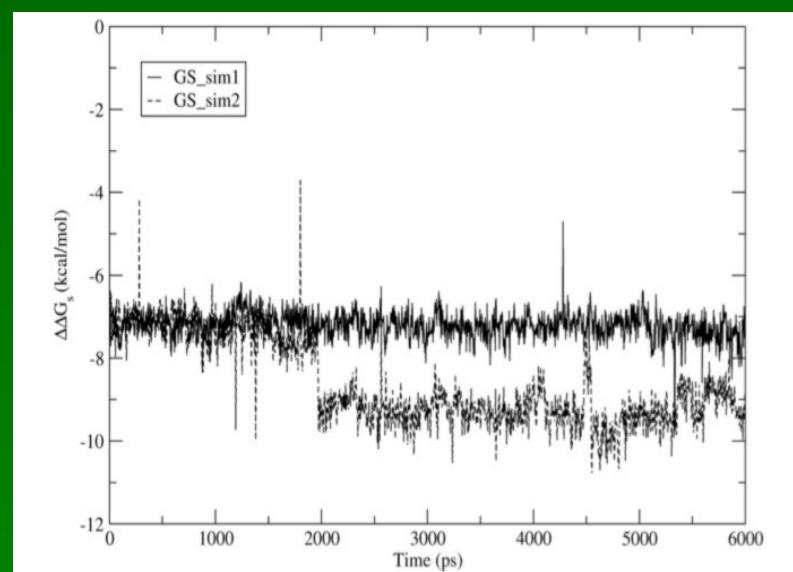
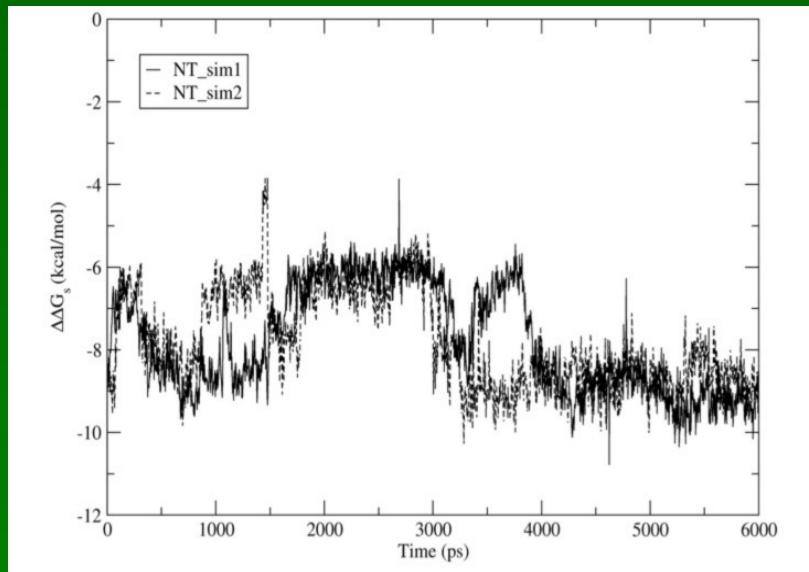
Belcher et al. 2005

Simulation of a selectively adhesive peptide for graphitic surfaces

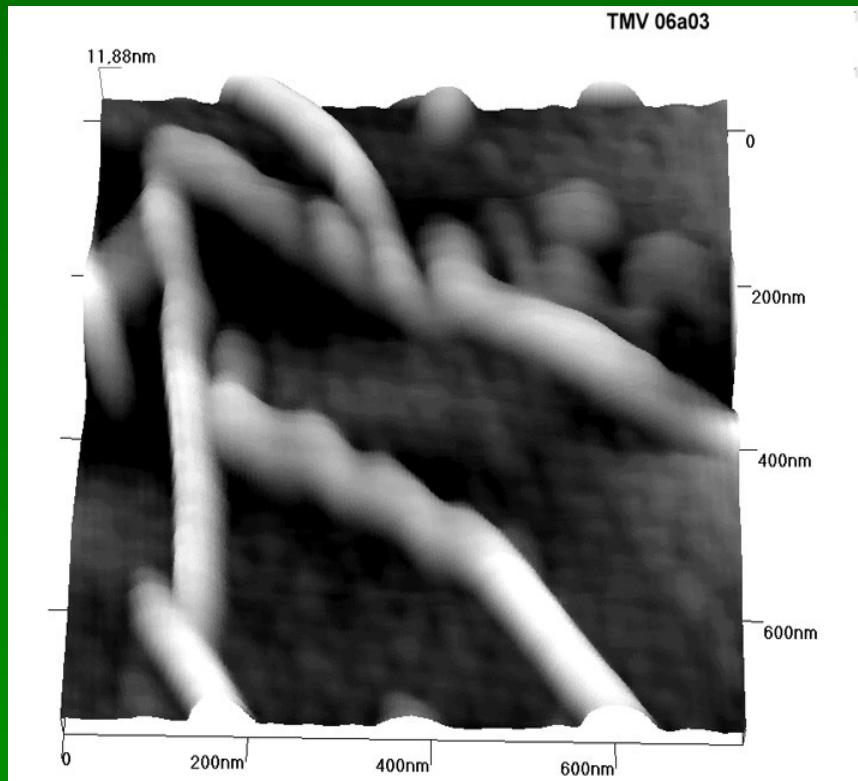


Adhesion vs simulation time for peptide on: SWCNT

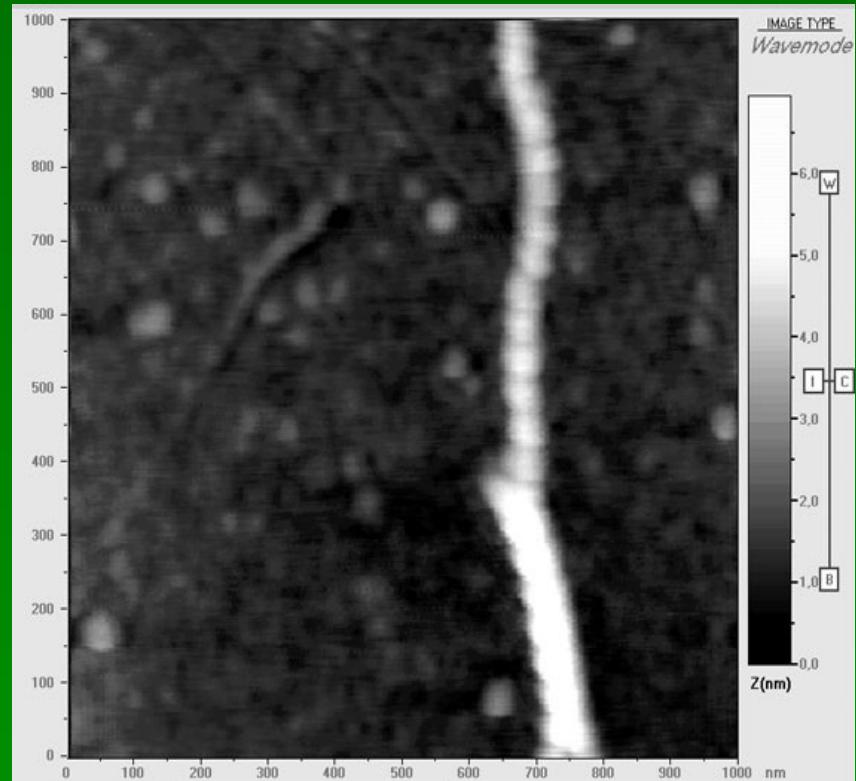
Flat graphite surface



AFM imaging of viral moulds



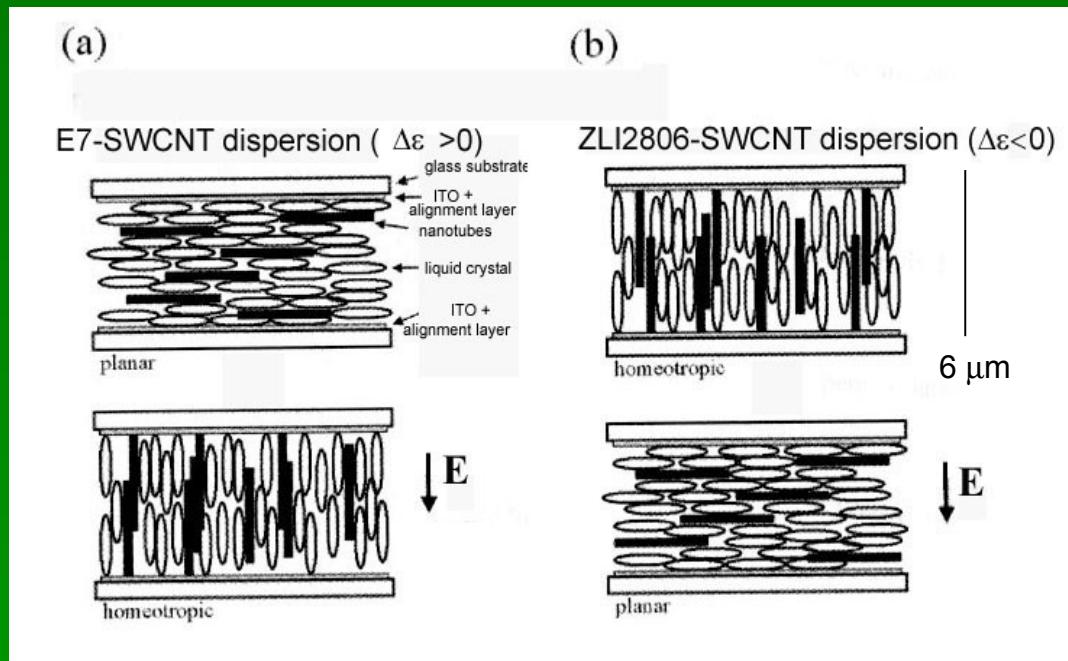
TMV



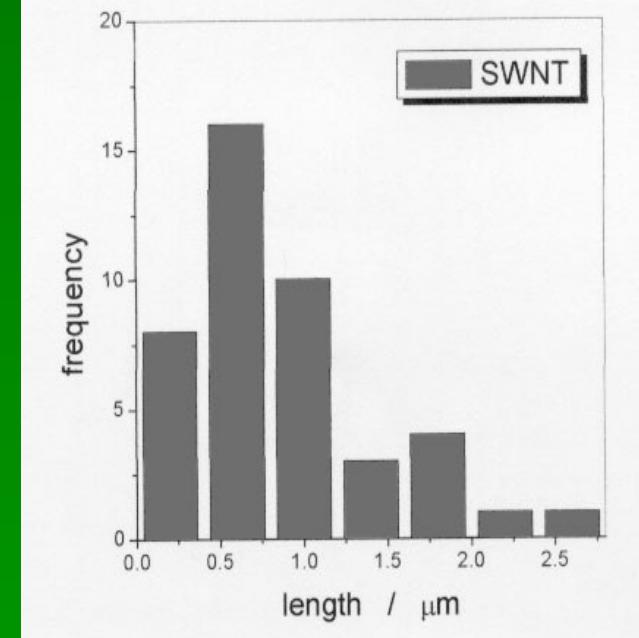
PVX

A NanoElectroMechanical Switch based on single wall carbon nanotubes dispersed in a Liquid Crystal cell

Two types of LC: parallel (E7) and perpendicular (ZLI2806) to applied E

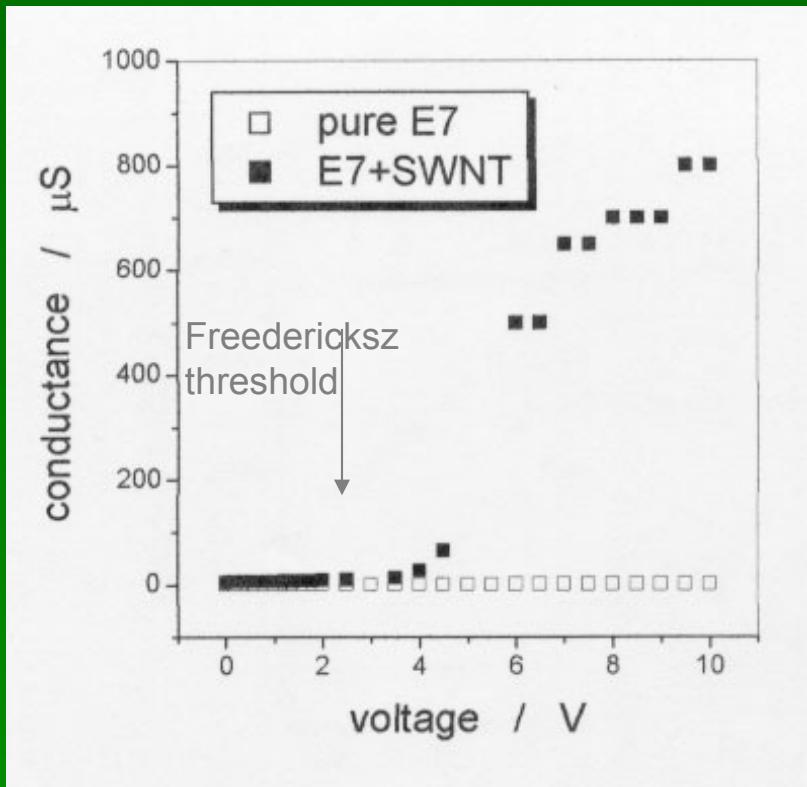


Distribution of SWCNT lengths
(average 600 nm)

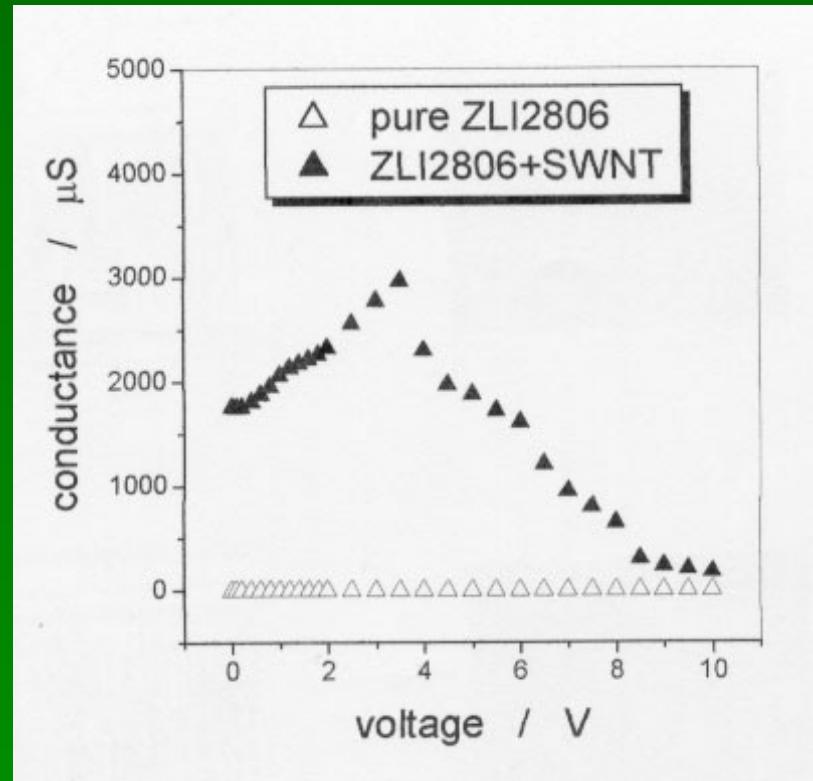


Conductance in SWCNT-liquid crystal mixtures

→



(E7, (ZLI2806, electric field reorients LC parallel to E)



(ZLI2806, electric field reorients LC perpendicular to E)

Nanotechnology tools



Heavy duty piezo inertial slider



Operating an STM under SEM observation