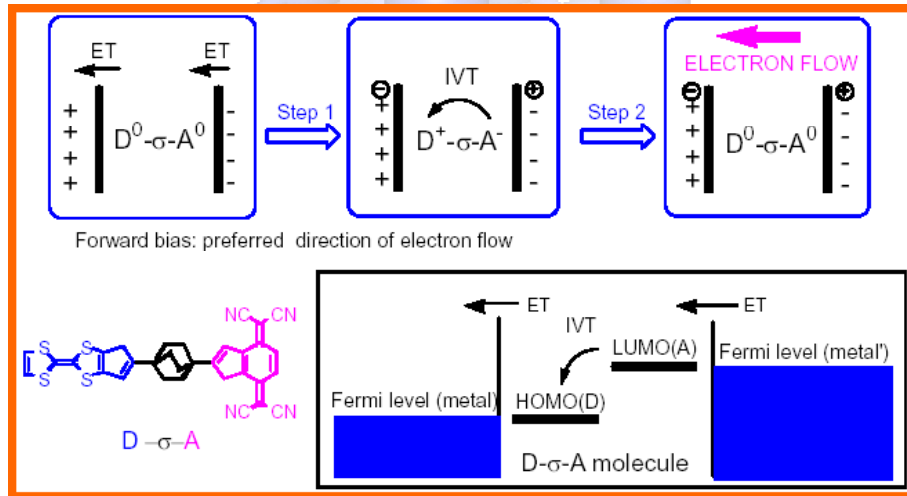
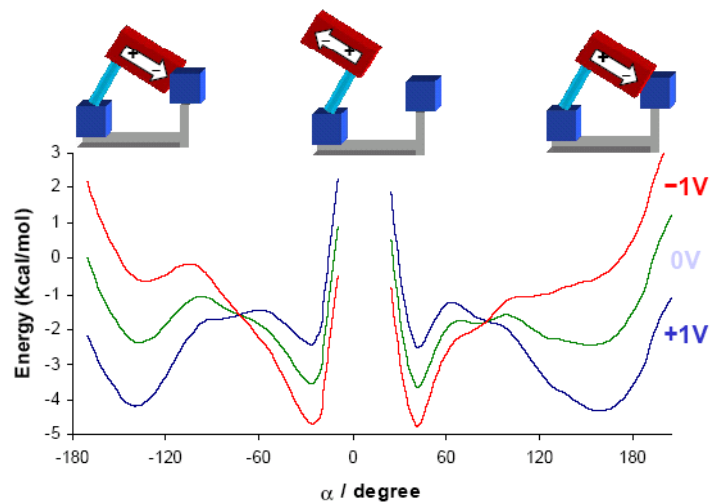
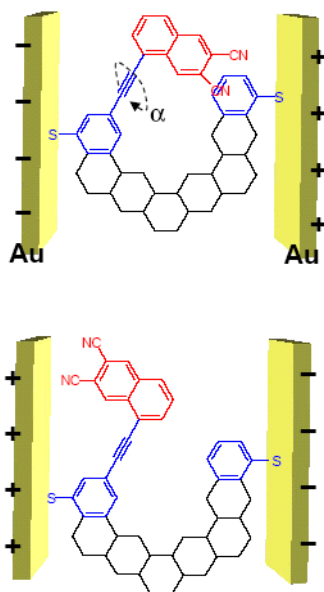


# Seeing the future-A proposal ahead of time

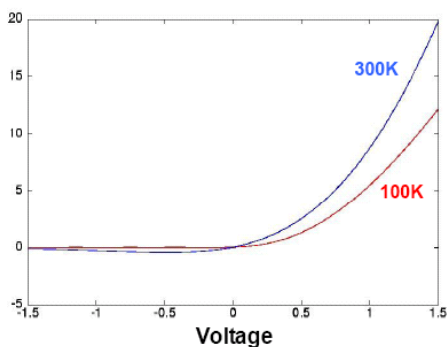
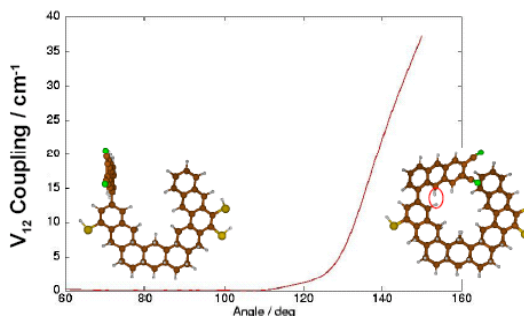
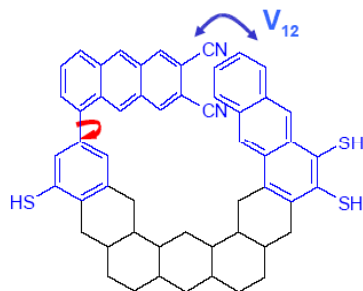


A. Aviram & M.A. Ratner (1974)

## A rectifier based on *intra-molecular structural changes* (a device minimally dependent on the metal-molecule contact)



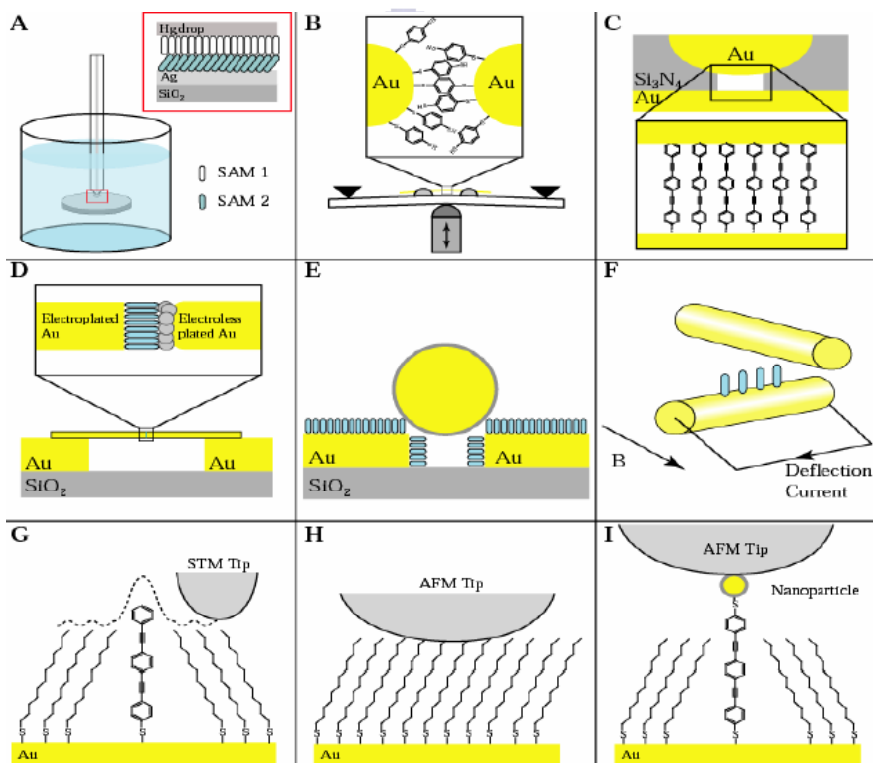
# A SYSTEM WITH ONLY ONE THROUGH-SPACE COUPLING AND VERY HIGH ON/OFF CONDUCTANCE RATIO



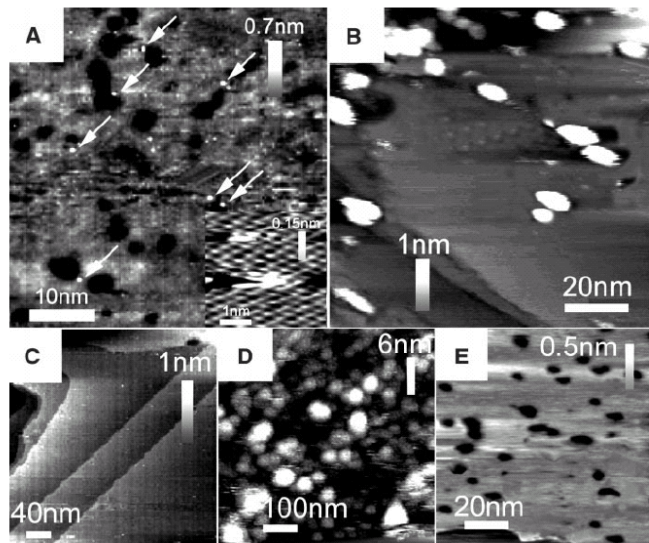
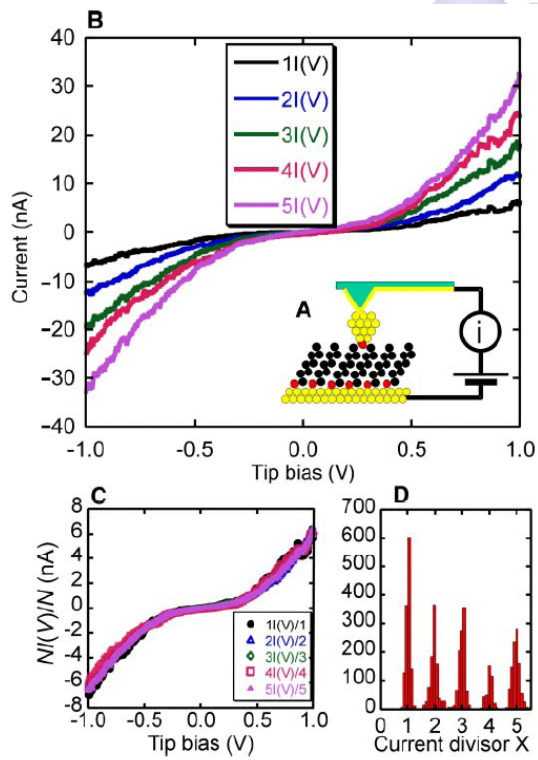
Giant Rectification/switch,  
With two electrodes  
From control of  
**stereochemistry**

Troisi and MR, 2003

## Cutting Edge Technologies in measuring small molecules

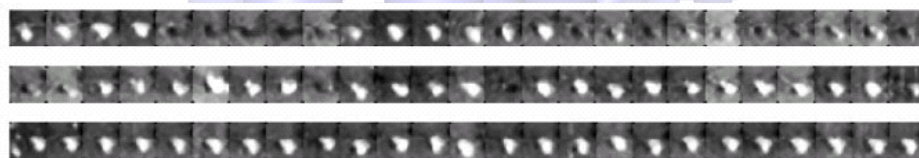
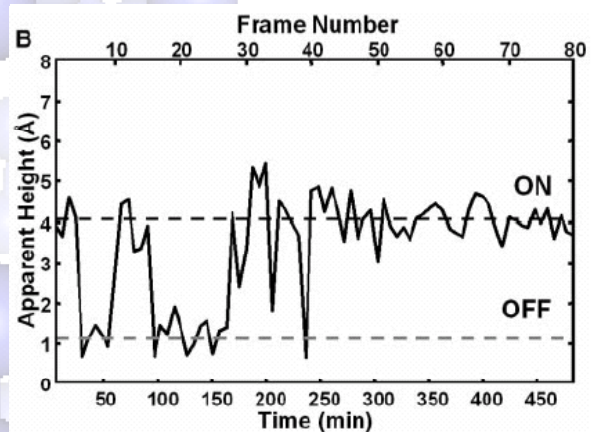
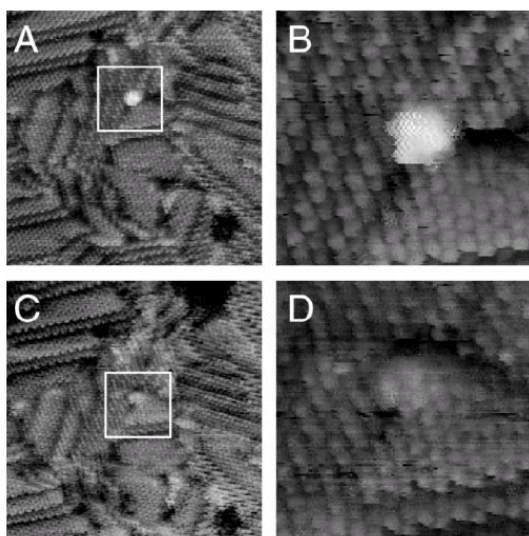


## Contact dependence of the molecules (I)



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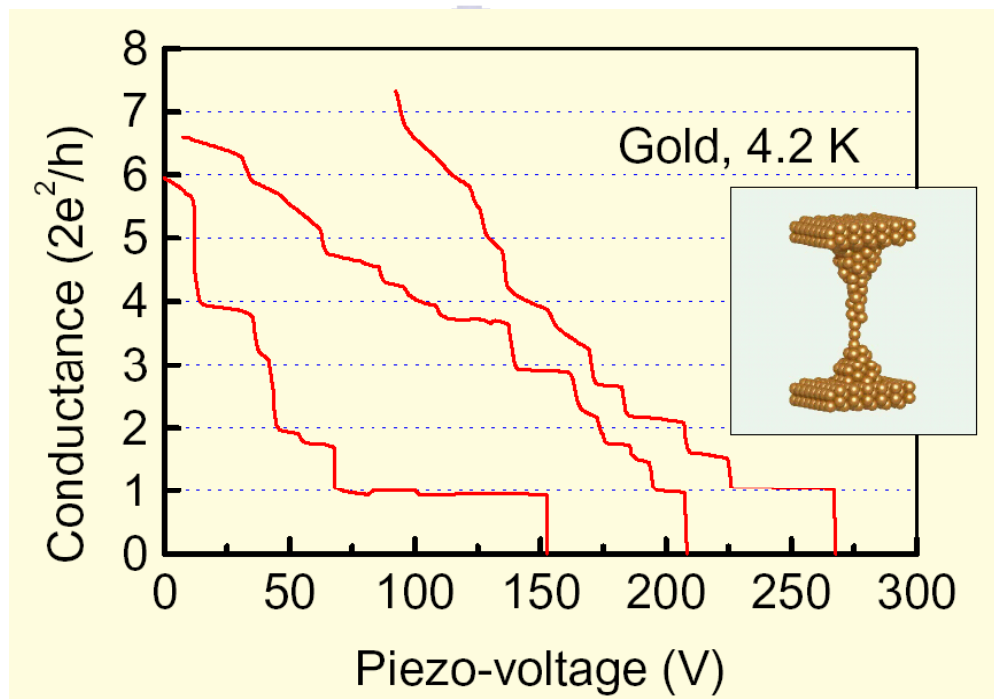
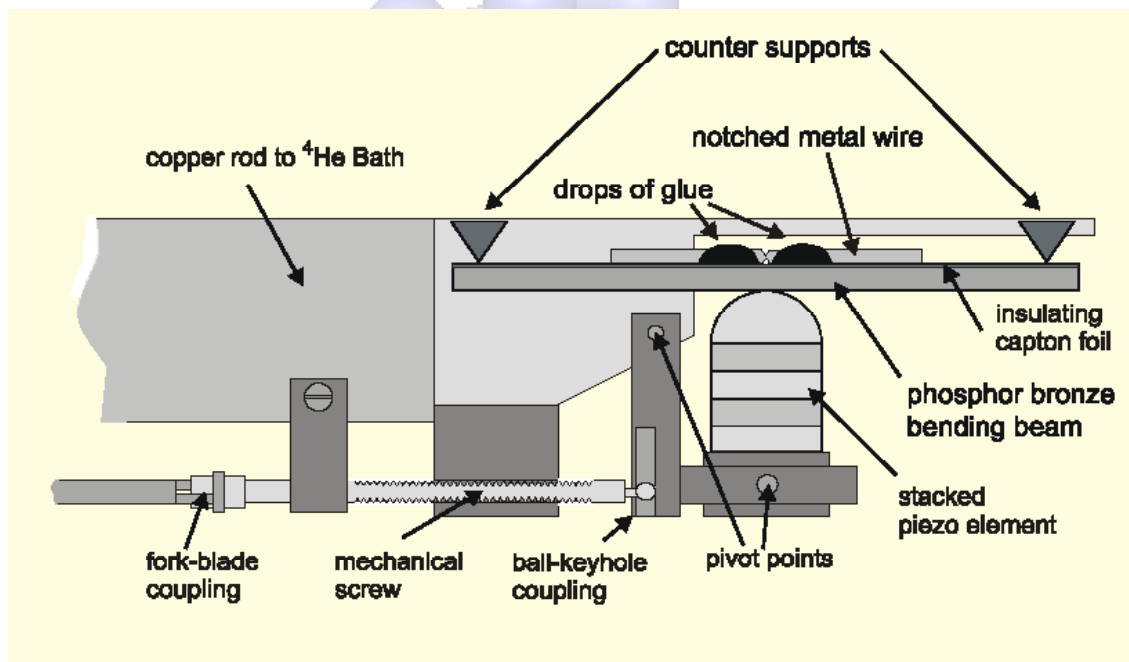
## Conductance switching in single molecule (G)



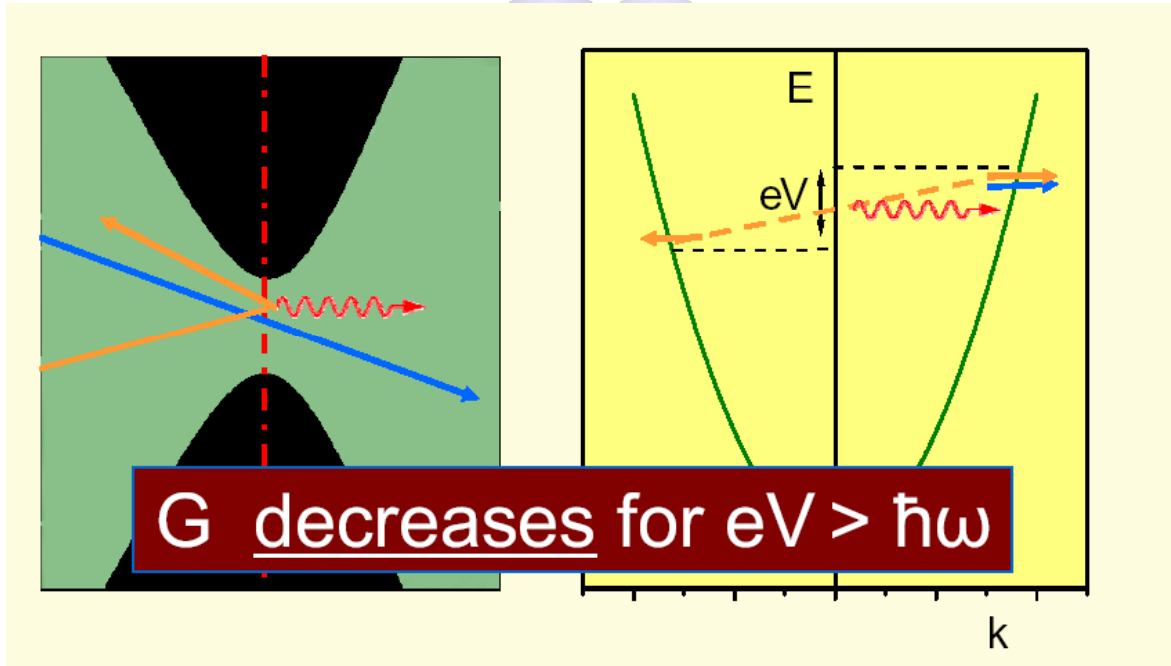
Donhauser et al., 2001

Nano Materials Research Team

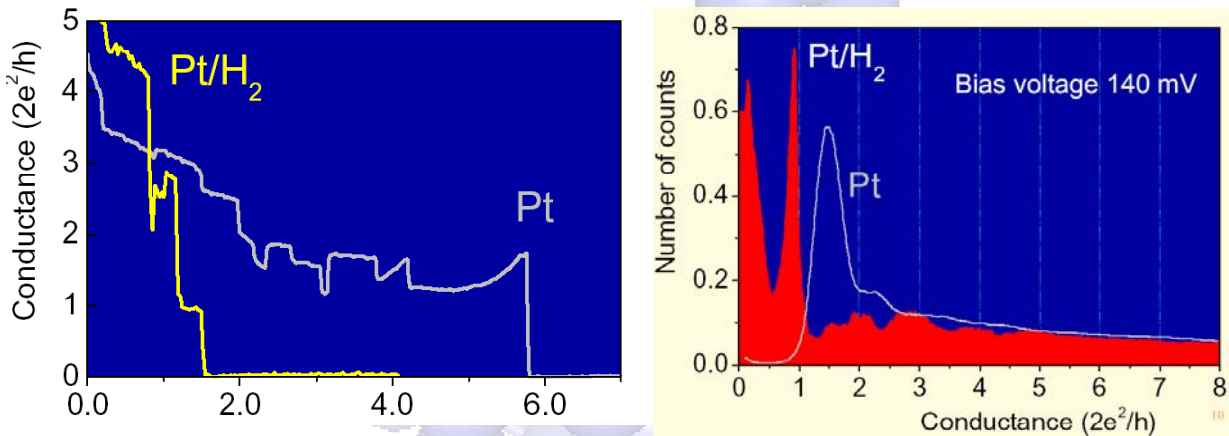
## Mechanically controllable break junction (B)



# Point contact spectroscopy

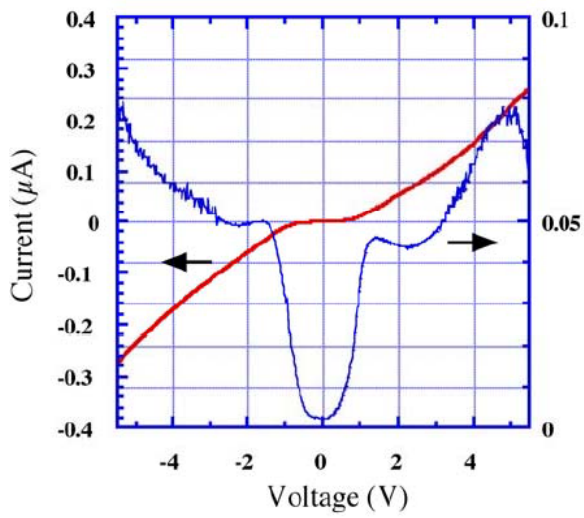


# Conductance from $H_2$ molecule

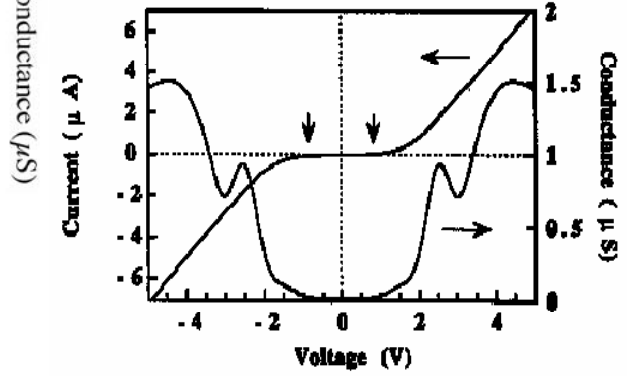
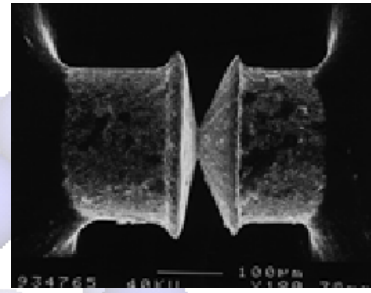


Jan van Reutenbeck, 2002

## MBJ with 1-4 benzenethiol

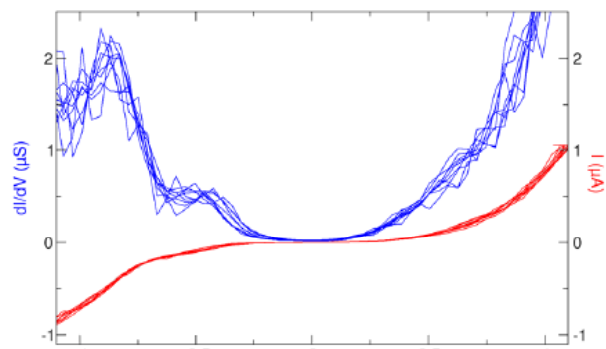
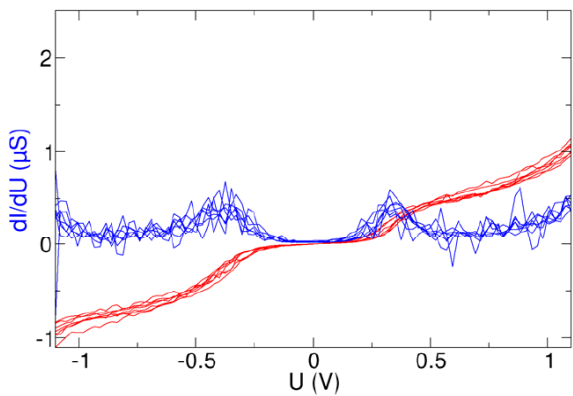
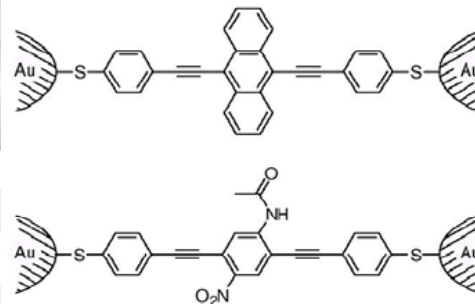
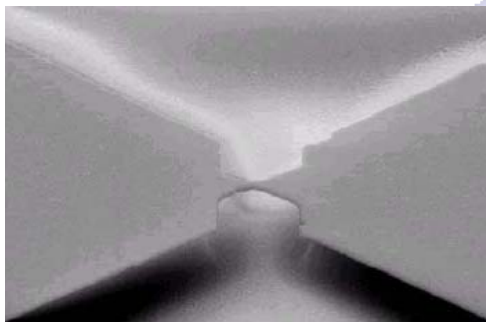


Reed et al., Science 278, 252



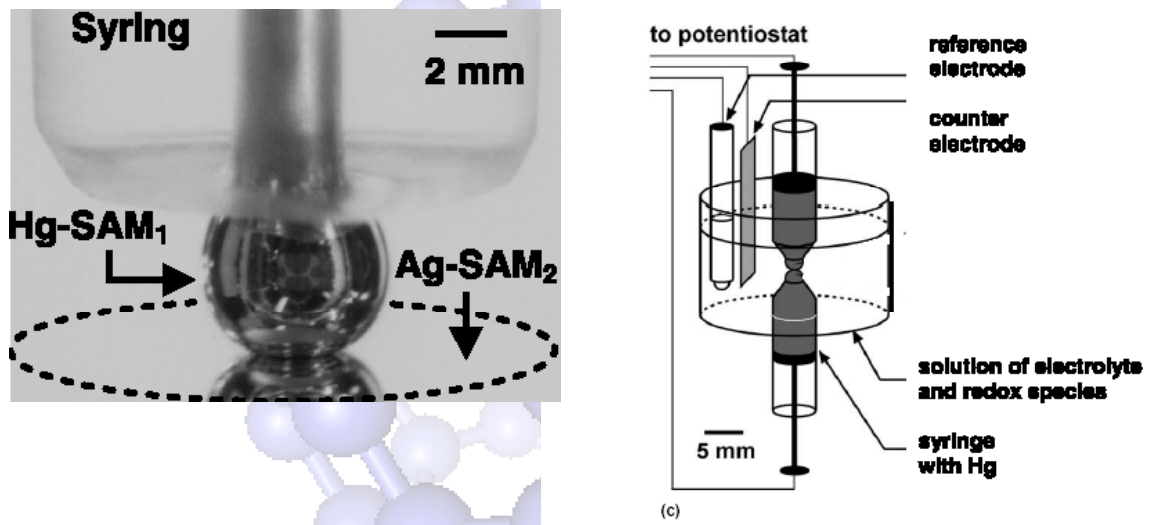
Di Ventra et al., PRL 84, 979

## Metallic breakjunction measurement

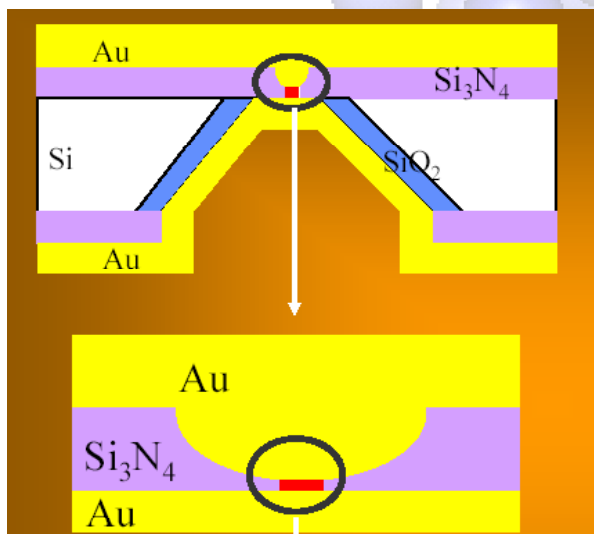


Reichert et al., PRL 88, 87604

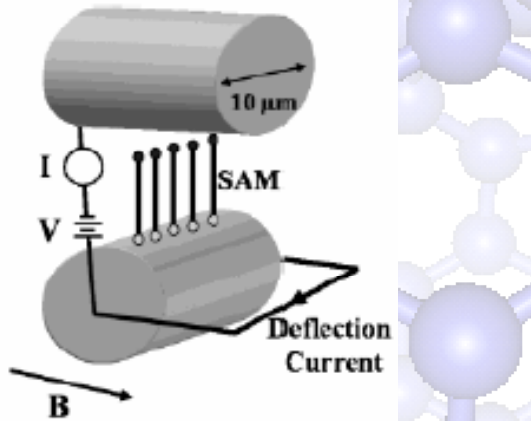
## Mercury Junction



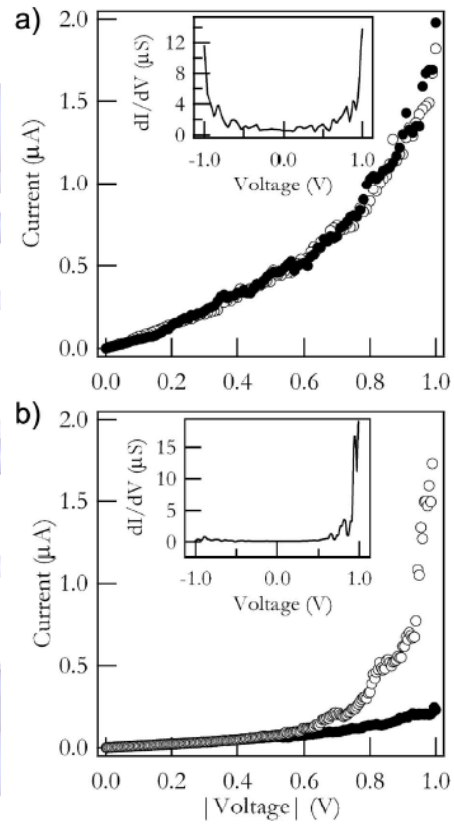
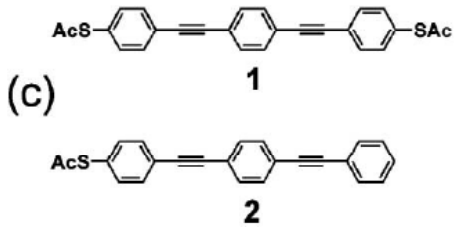
## Nanopore measurement (c)



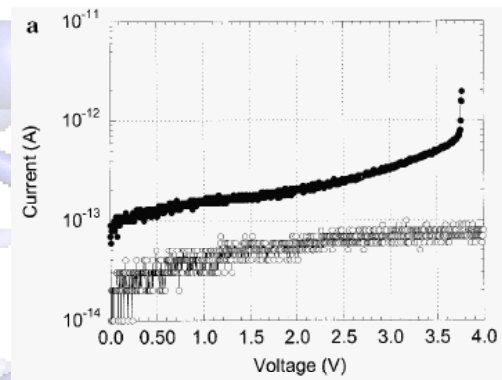
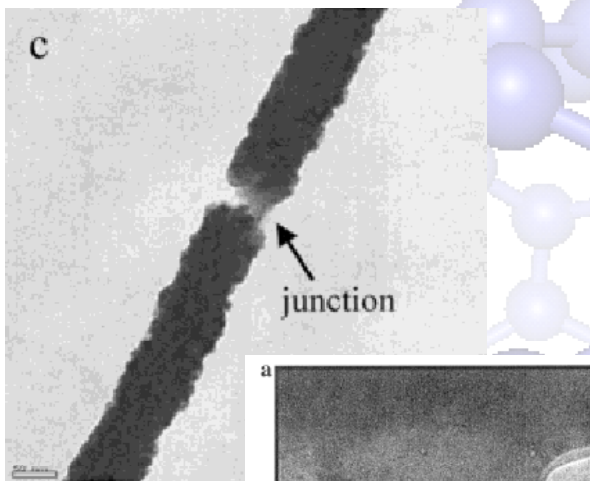
## Cross wire junctions (F)



Kushmerick et al., 2002



## Nanowire junction (D)

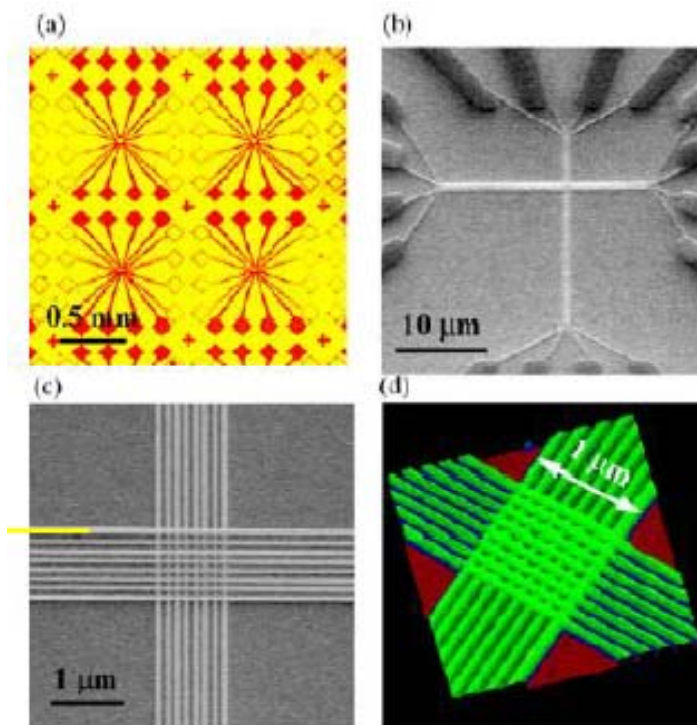




### Nanoparticle trapped junction

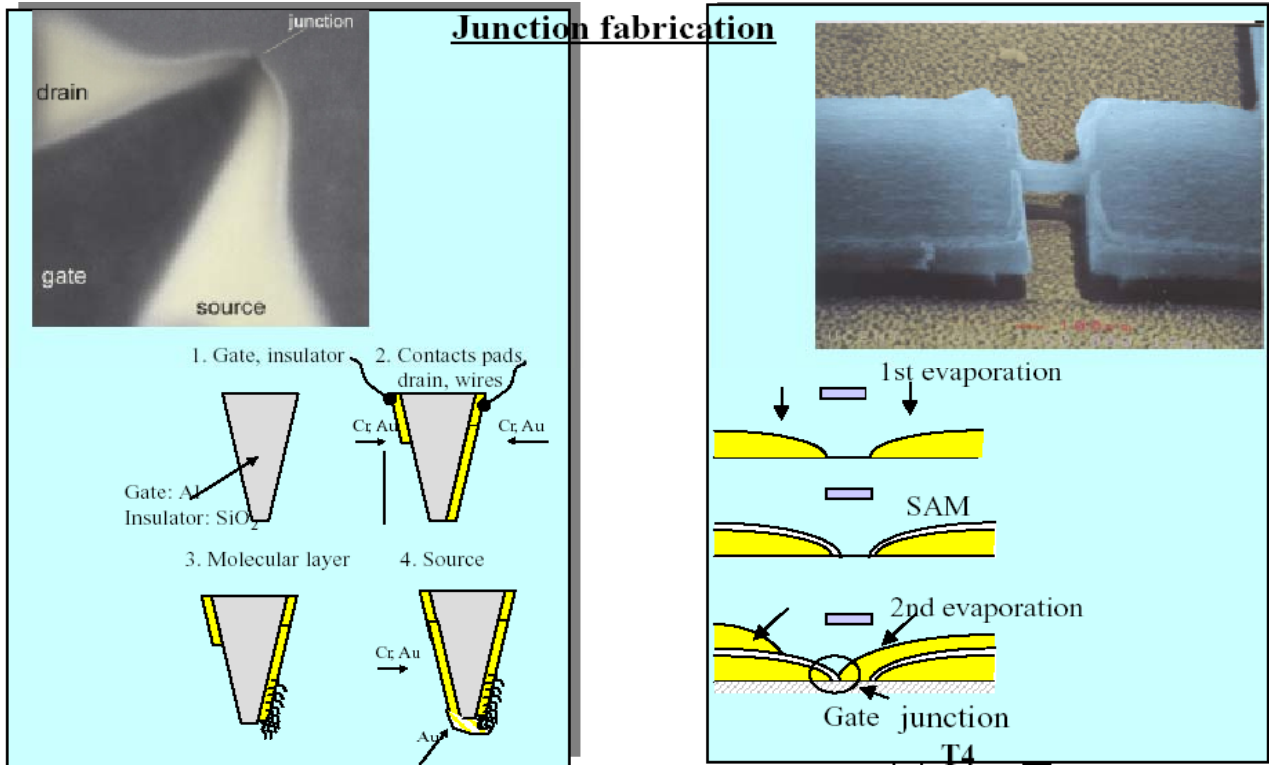


### Nanowire cross junction (G)



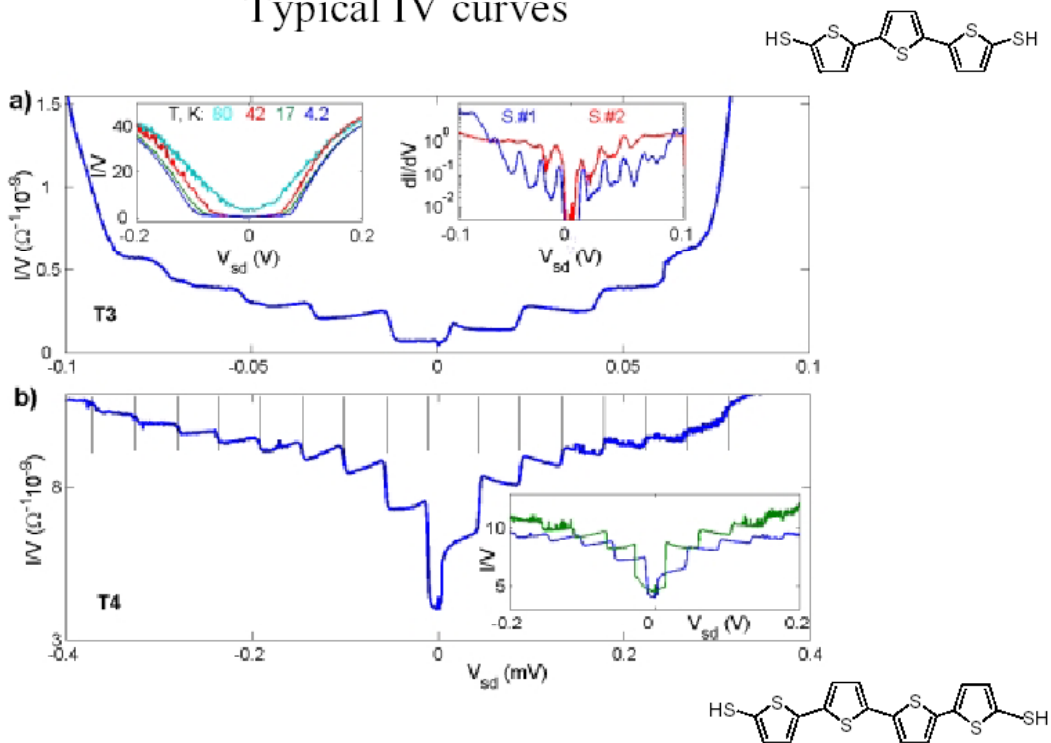
Y. Chen et al.2003

Tip measure-N. Zhitenev et al., 2002



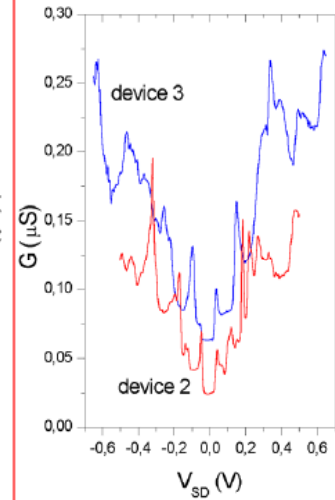
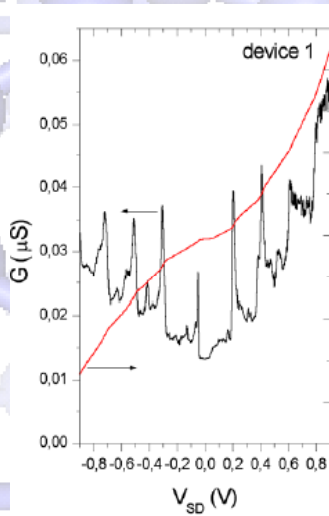
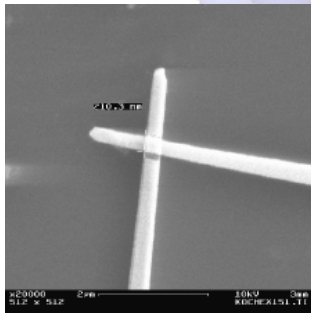
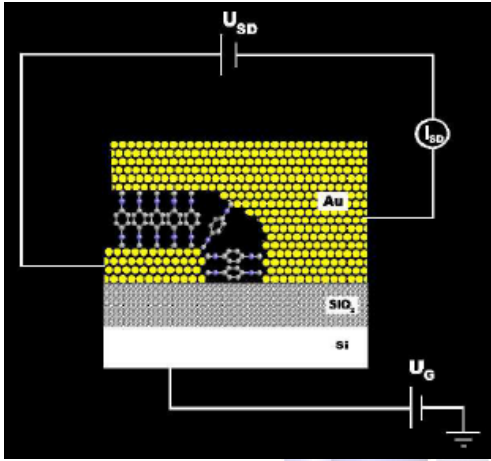
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### Typical IV curves



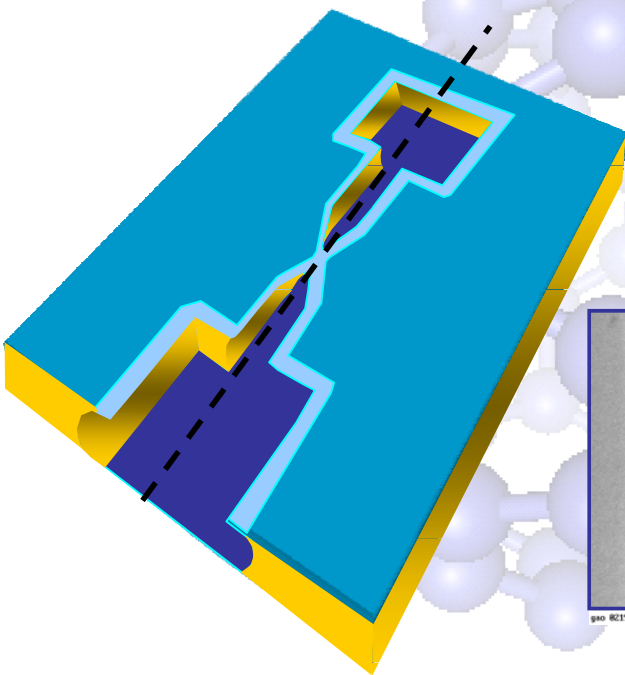
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# Sandwich junction-Planar

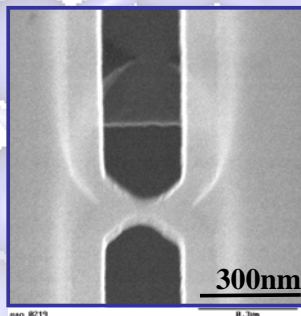


C. Dupraz et al., 2003

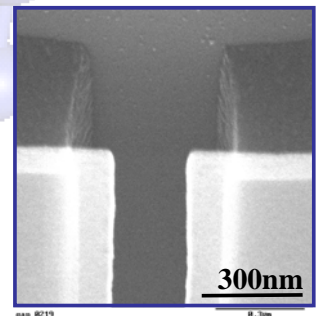
# Sandwich junction-Planar



- Resist bridge that can stand the growth of the molecules
- Without lift-off process
- Controllable contact area

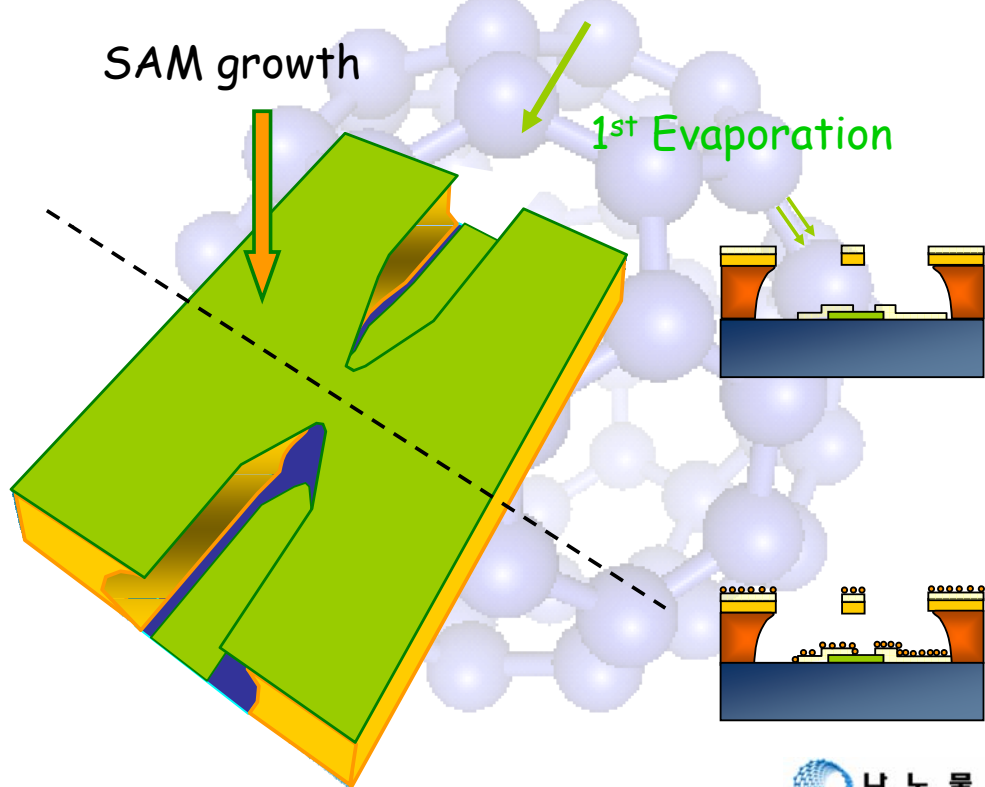


Tilted 45°

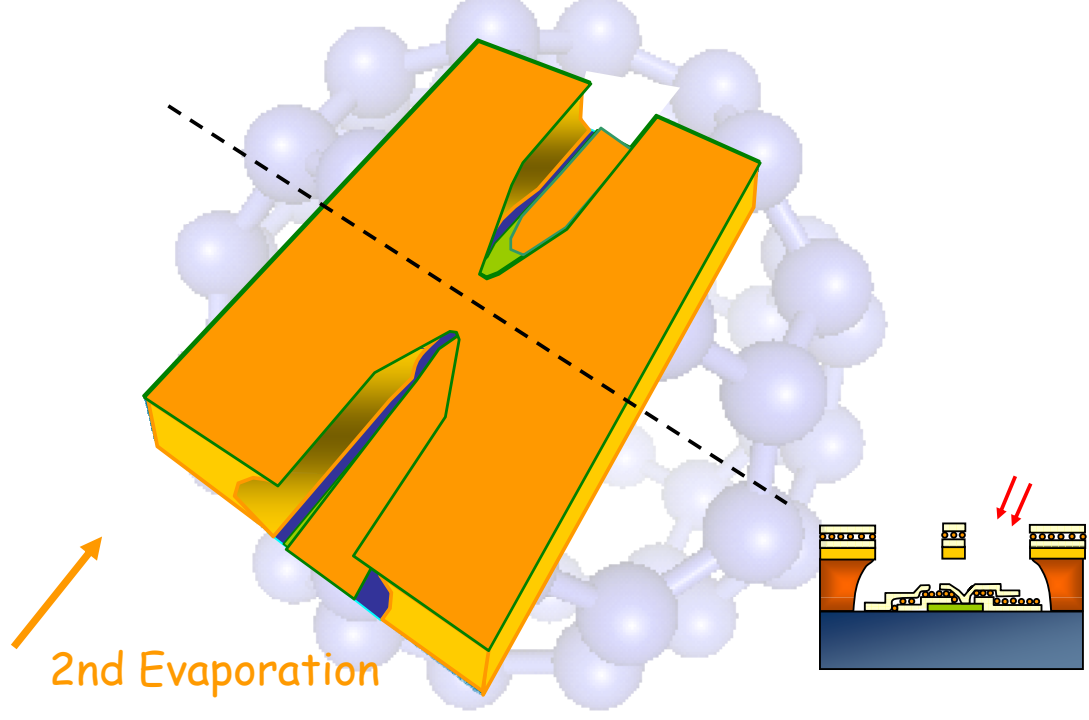


Tilted 45°

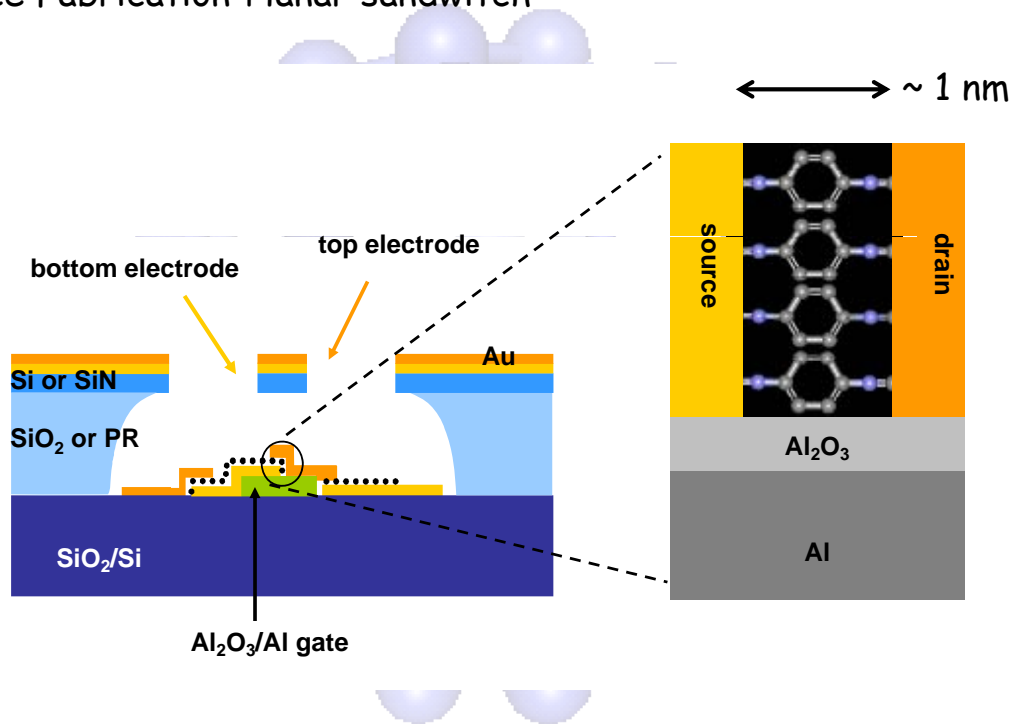
Device Fabrication-Planar sandwich



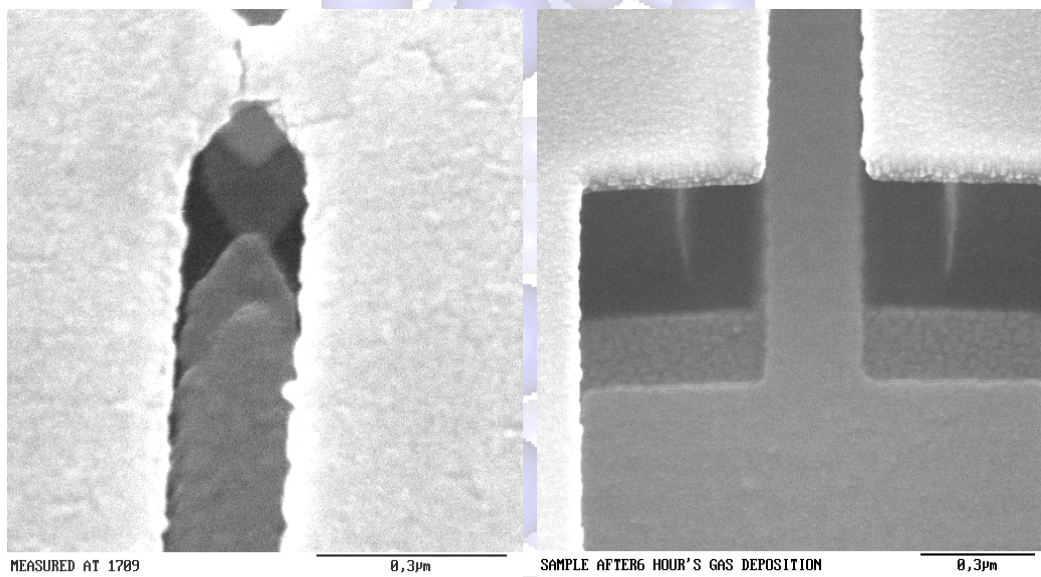
Device Fabrication-Planar sandwich



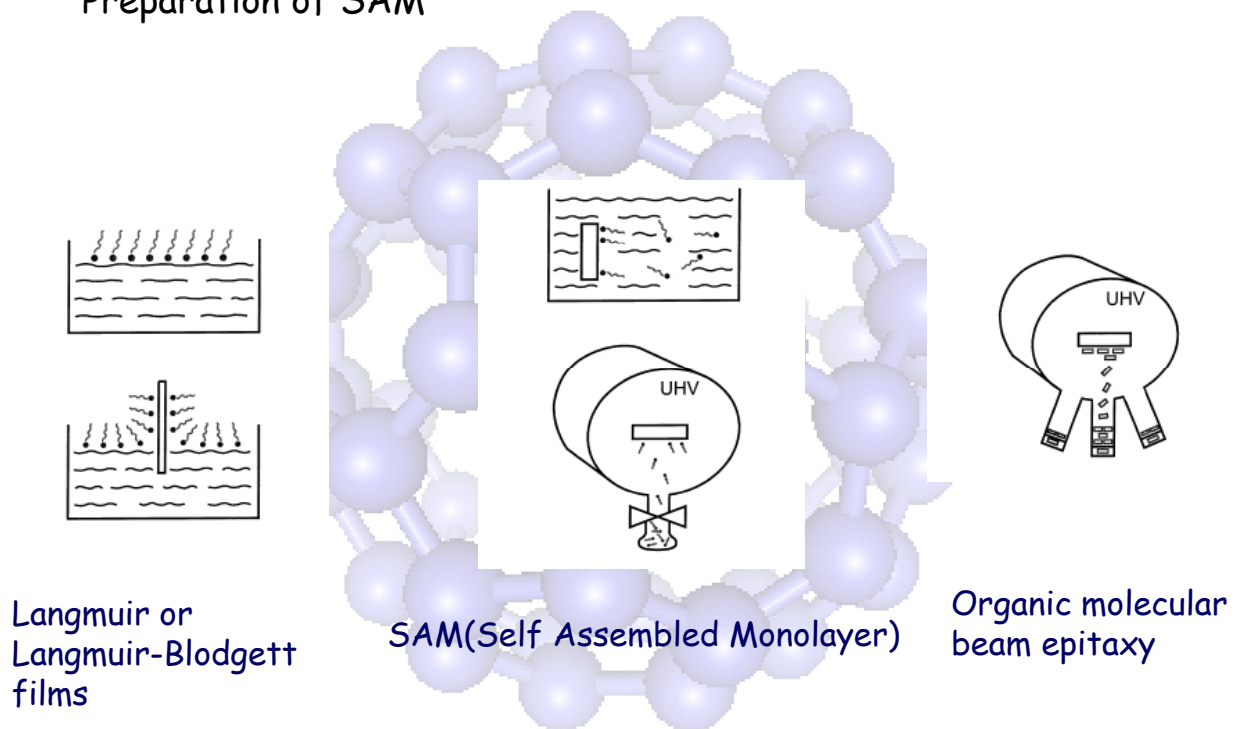
## Device Fabrication-Planar sandwich



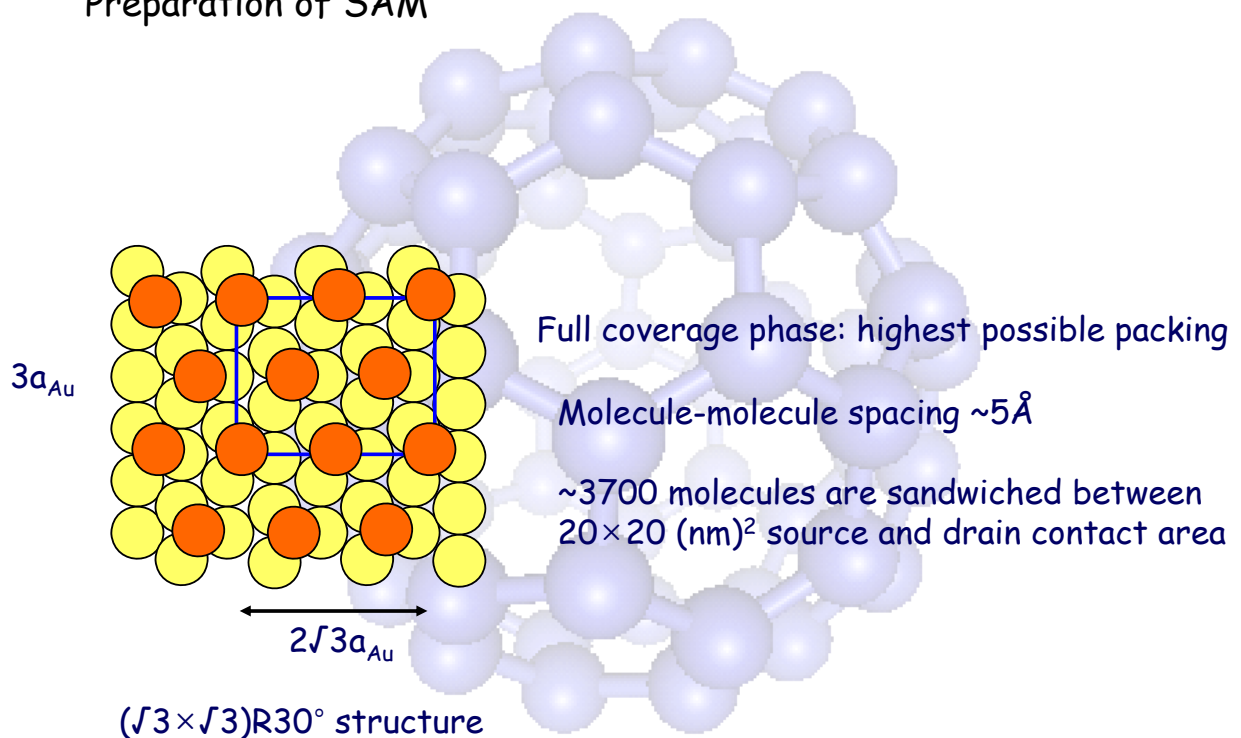
## Device Fabrication-Planar sandwich



## Preparation of SAM



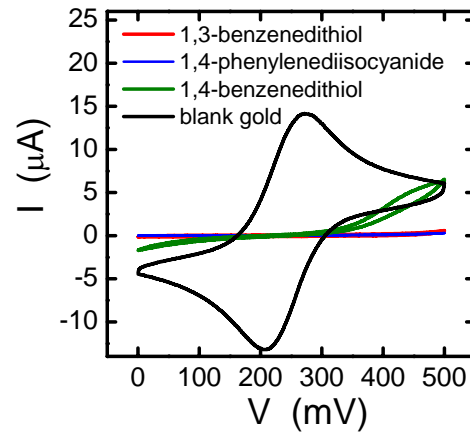
## Preparation of SAM



## Growth of a self-assembled monolayer of molecules

Gas phase deposition

Electrochemical testing of the monolayer



Molecules	Yield (%)	Total # of fabricated samples	Gate dependent samples	Liquid growth	Gas phase SAM growth	characteristics
1 	7.8	256	2	Y	Y	Asymmetric $I-V$
2 	0	216	0	Y	Y	
3 	16	236	0	Y	Y	NDC
4 	5	108	0	Y	N	NDC
5 	0	72	0	Y	N	