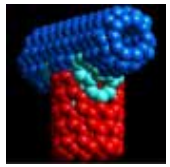
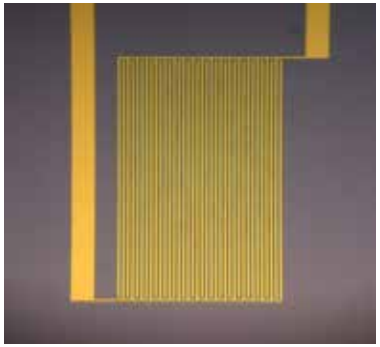
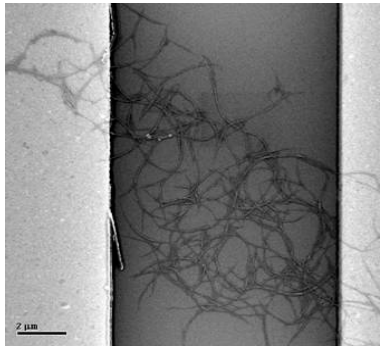
SWCNT Chemiresistor



- Easy production by simple microfabrication, compared to FETs
- 2 Terminal I-V measurement
- Low energy barrier - Room temperature sensing
- Low power consumption: 50-100 µW/sensor



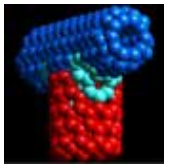


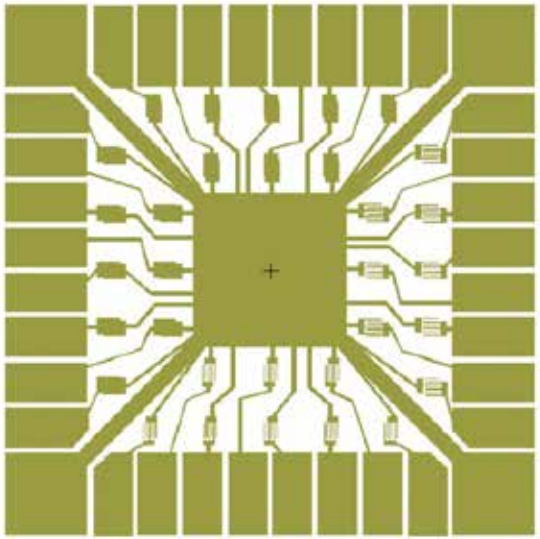
Processing Steps

1. Interdigited microscale electrode device fabrication
2. Disperse purified nanotubes in DMF (dimethyl formamide) or other solvent
3. Solution casting of CNTs across the electrodes

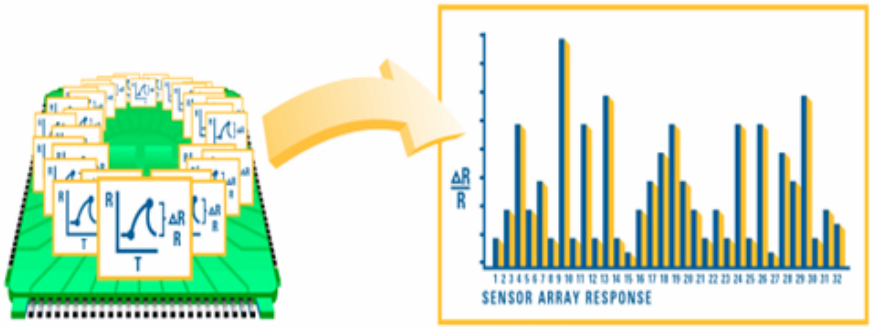
Nano Lett., **3**, 929 (2003)

Nanosensing Approach: Selectivity





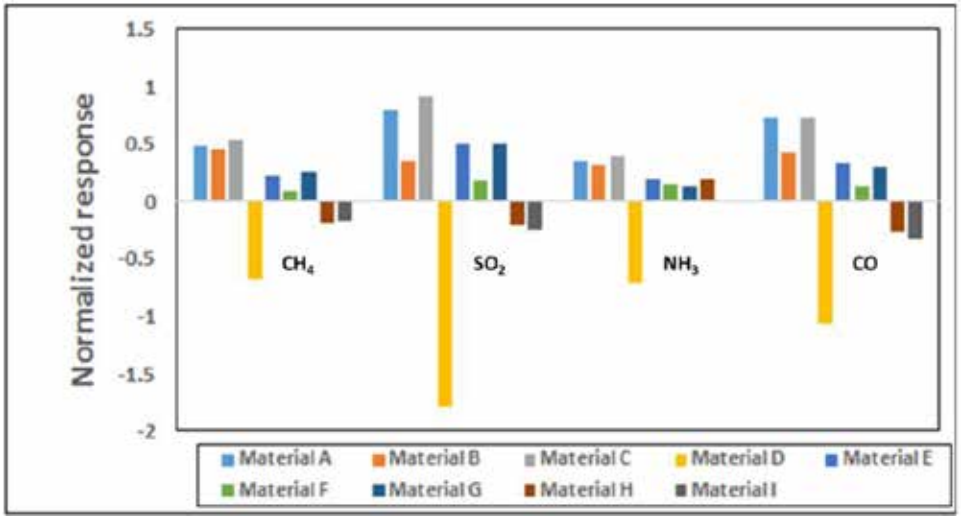
- Use a sensor array
- Variations among sensors - critical
  - physical differences (minor help)
  - coating, functionalization
  - doping
  - oxide nanowires, nanoparticles
  - graphene, its variations



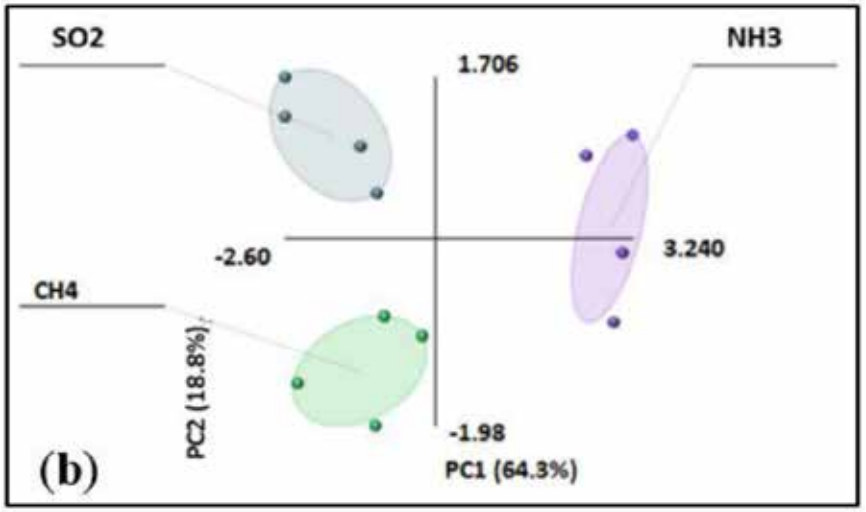
Using pattern matching algorithms, the data is converted into a unique response pattern

Operation:

1. The relative change of current or resistance is correlated to the concentration of analyte.
2. Array device “learns” the response pattern in the *training* mode.
3. Unknowns are then classified in the *identification* mode.



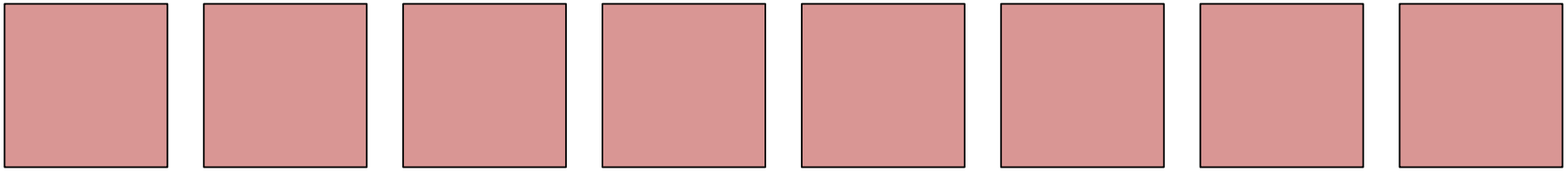
Normalized response in bar chart form for 25 ppm concentration of target gases CH_4, SO_2,NH_3, and CO.



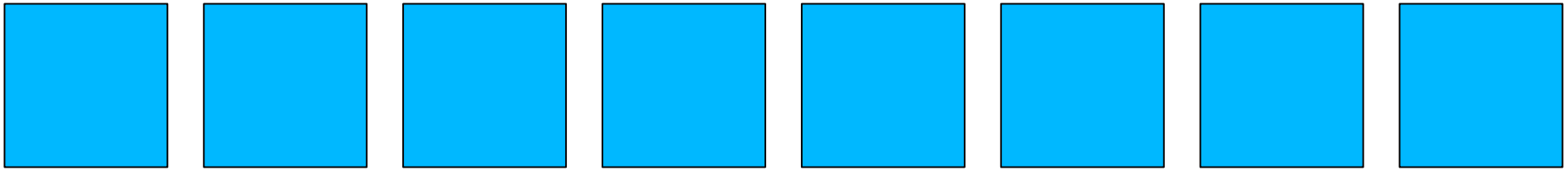
Principal component analysis of sensor array response to CH_4,SO_2, and NH_3.

Published in: Ami Hannon; Yijiang Lu; Jing Li; M. Meyyappan; *Sensors* **2003,** 16(8), 1163.
DOI: 10.3390/s16081163

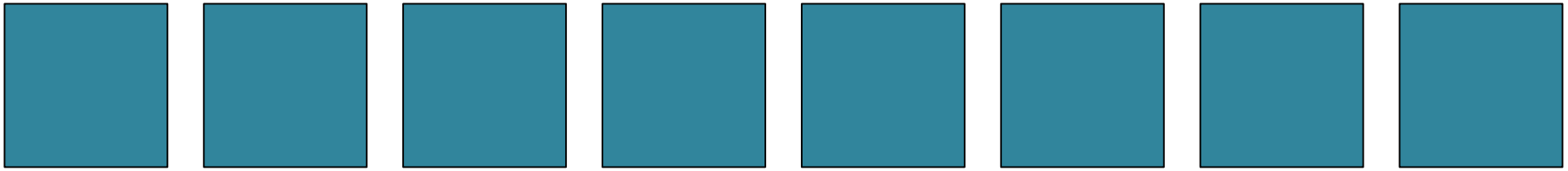
Carboxylic SWCNTs



Sulfonated SWCNTs



Hydroxyl-functionalized SWCNTs



Polyaniline