

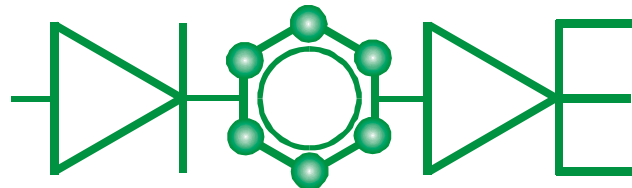
Gianina Nicoleta Gavrilă

PhD Student

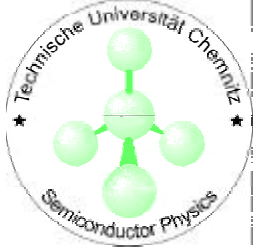
Semiconductor Physics, TU Chemnitz



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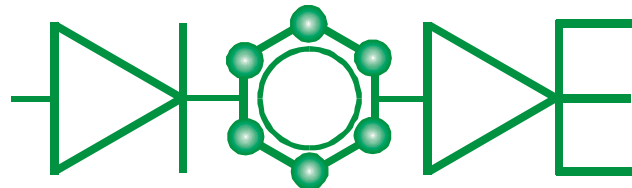
Gianina N. Gavrilă
TU Chemnitz



- Romanian nationality
- Faculty of Physics at „Babes-Bolyai“ University, Cluj Napoca
Diploma Degree
“EXAFS and XRD studies on Ni supported catalysts”
- Master of Science studies in collaboration with TU Chemnitz:
“Ultra-violet photoemission and Kelvin Probe measurements on
Inorganic and Organic surfaces”
- oct. 2001: joining the Diode Network as Young Researcher



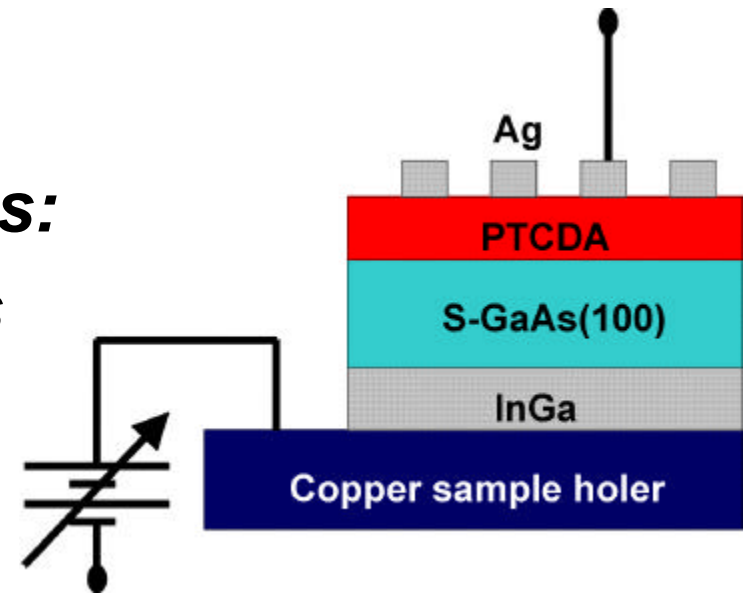
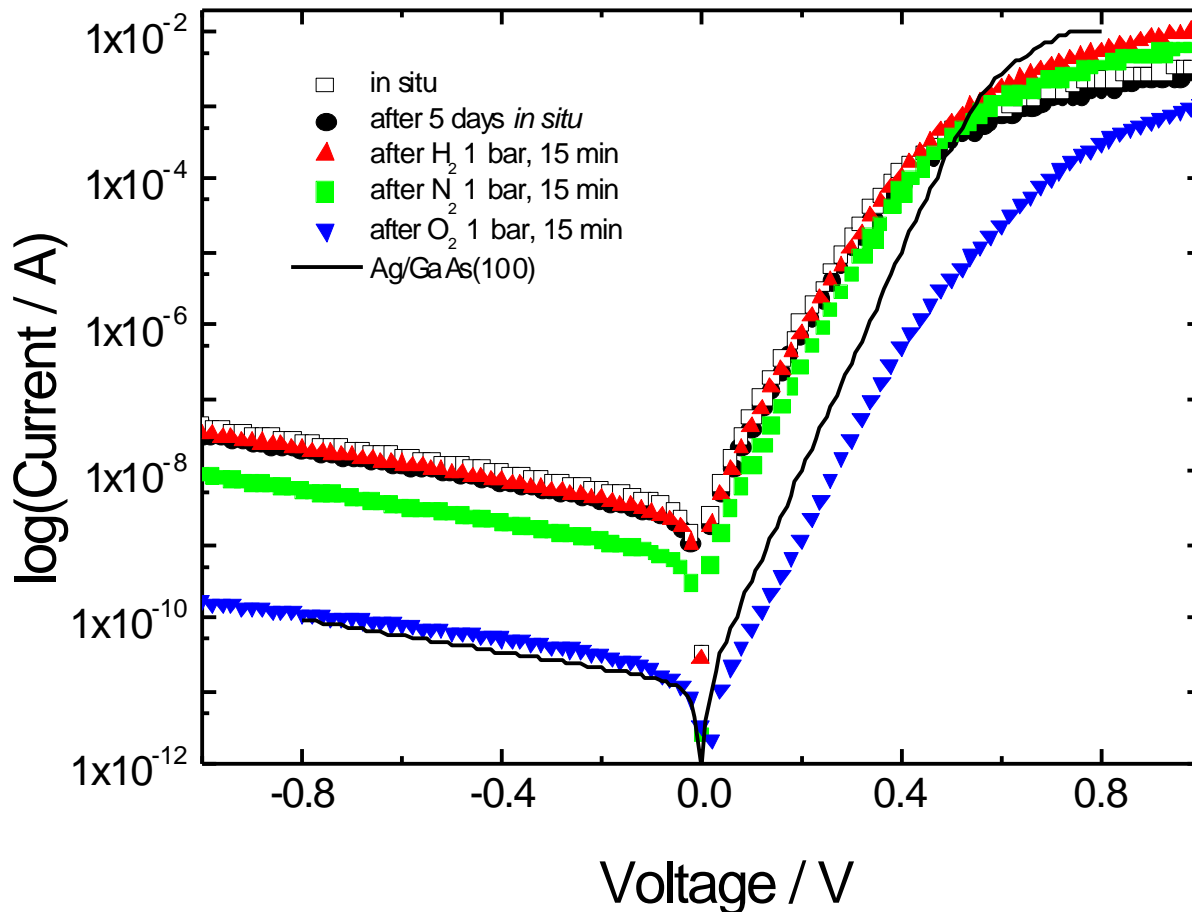
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Motivation:

Ag/PTCDA/S-GaAs Schottky diodes: current-voltage characteristics

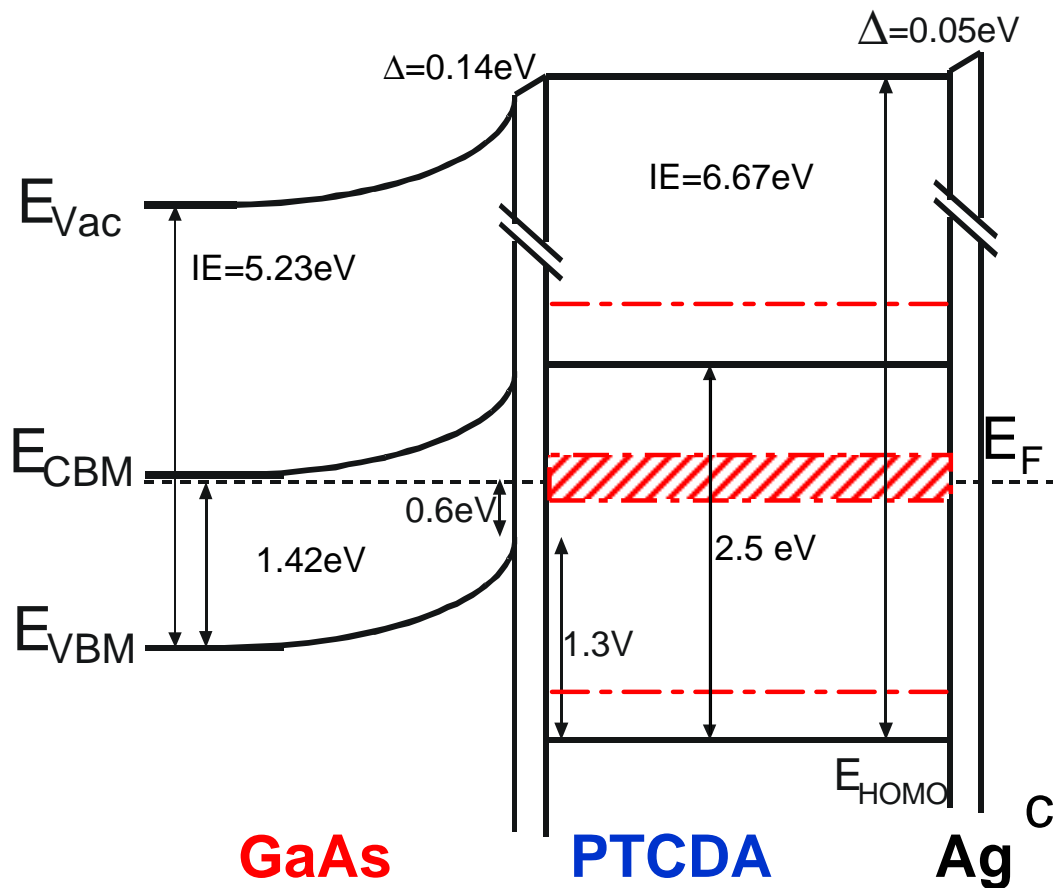


- Exposure to air accelerates the decrease in current.
- ? Creation of e^- traps in PTCDA layer (bulk effect)
- ? Change in barrier height (interface effect)

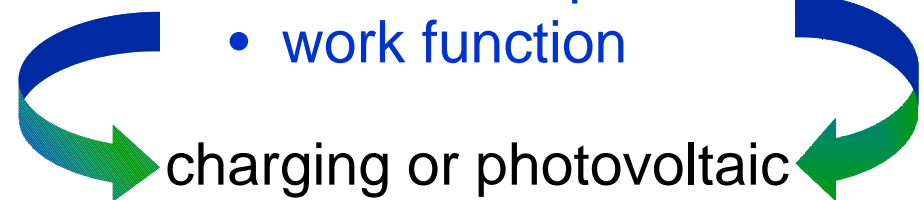
Energy Band Diagram

- modelling of energy diagrams employing techniques like :

Ultra-violet Photoemission Spectroscopy and **Kelvin Probe Method**



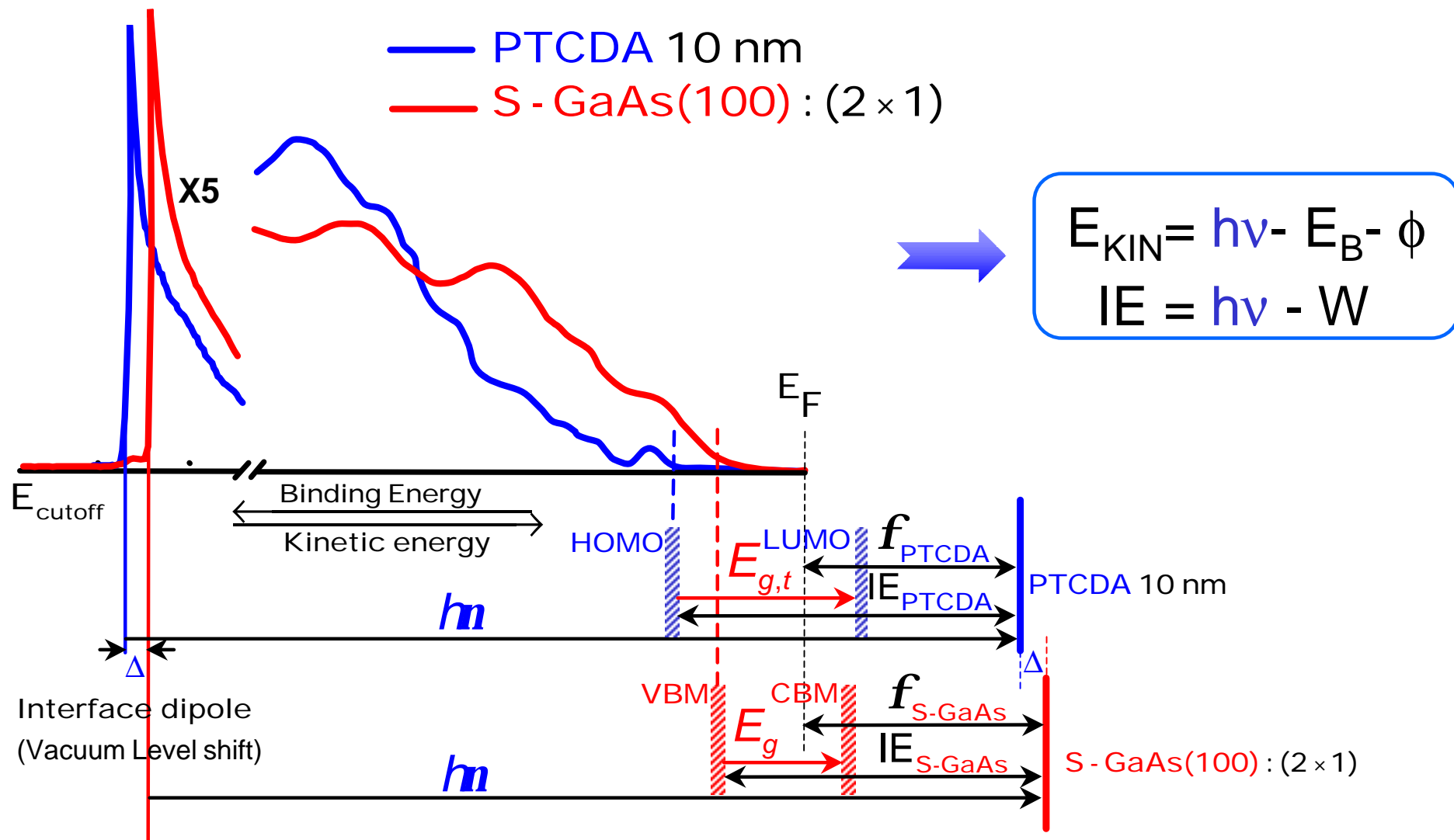
- ionisation energy
- E_{HOMO}/E_{VBM}
- interface dipole
- work function



Kelvin Probe Method:

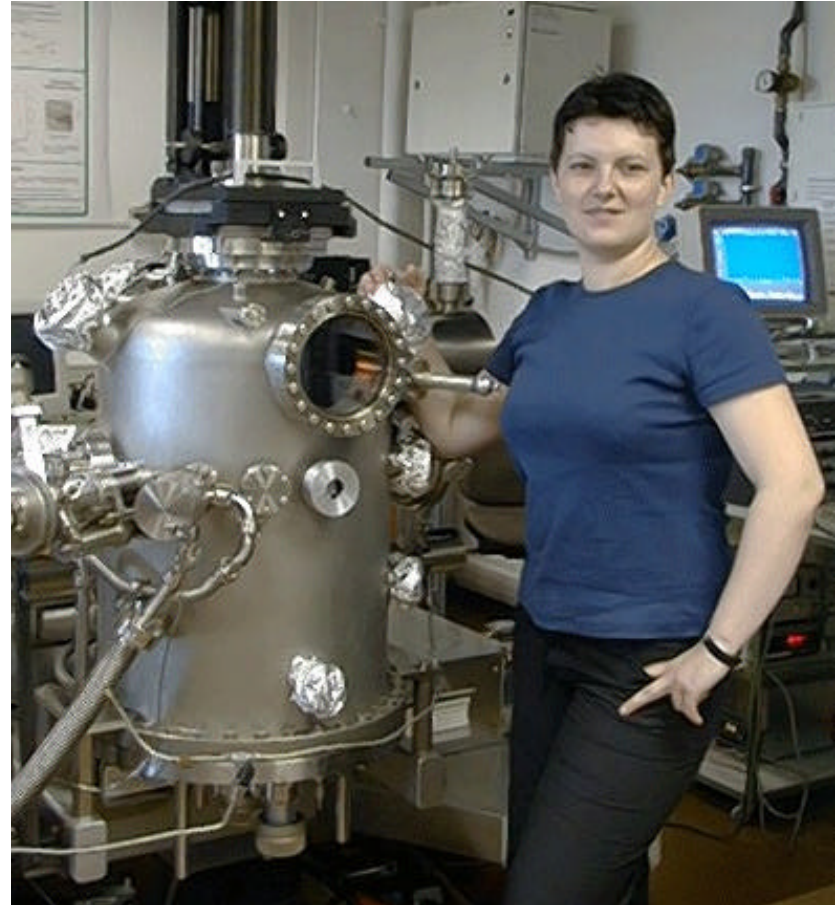
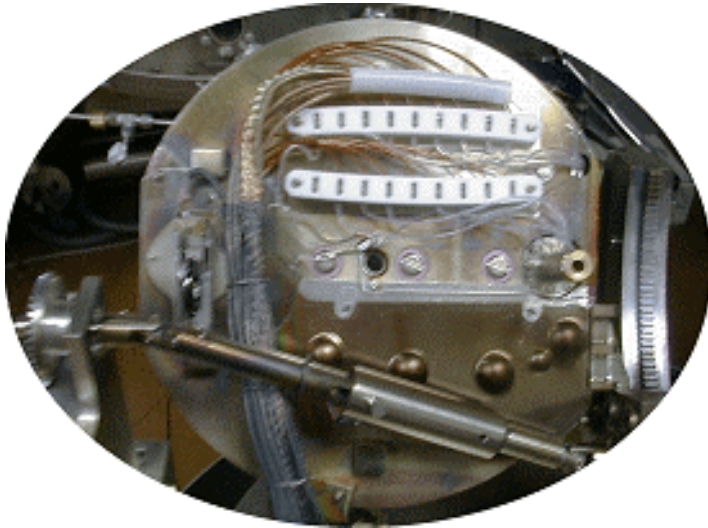
complementary technique for measuring changes in work function

Determination of **Energy Diagram** using Photoemission Spectroscopy

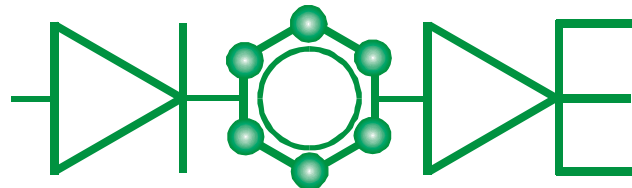


Photoemission Spectroscopy:

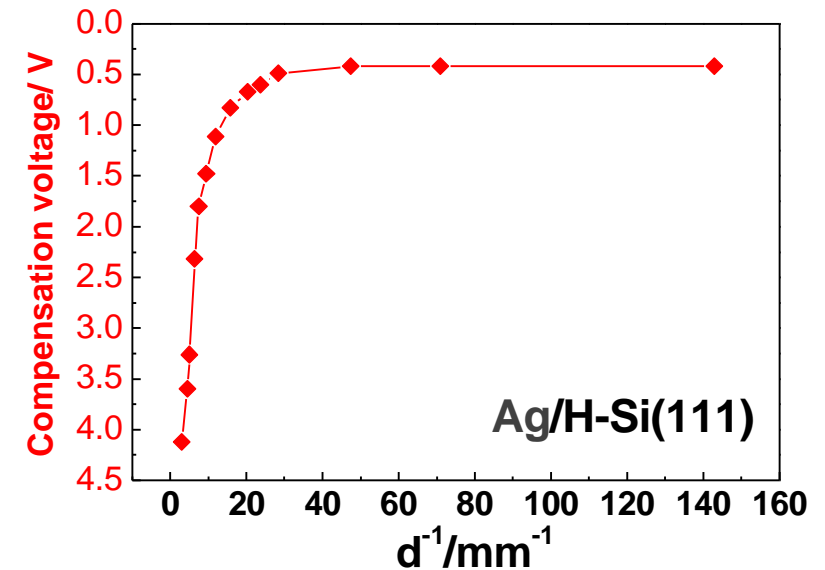
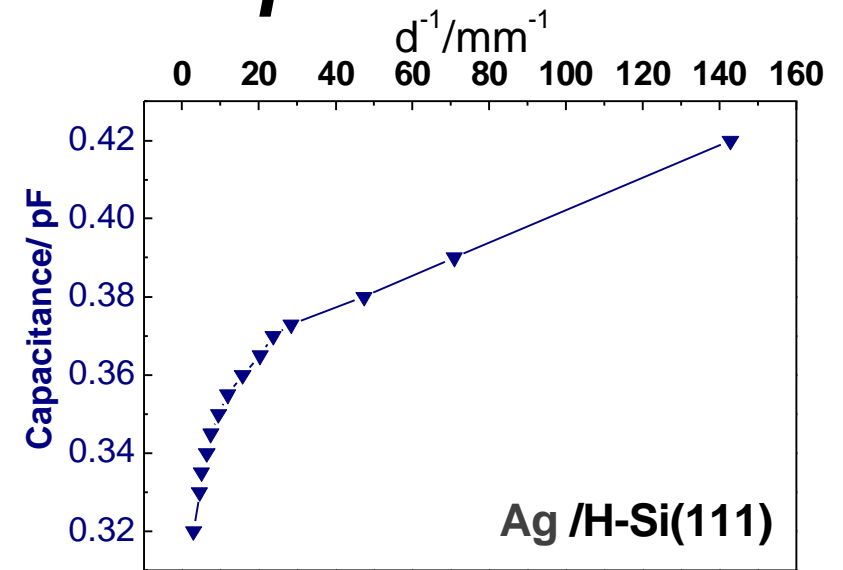
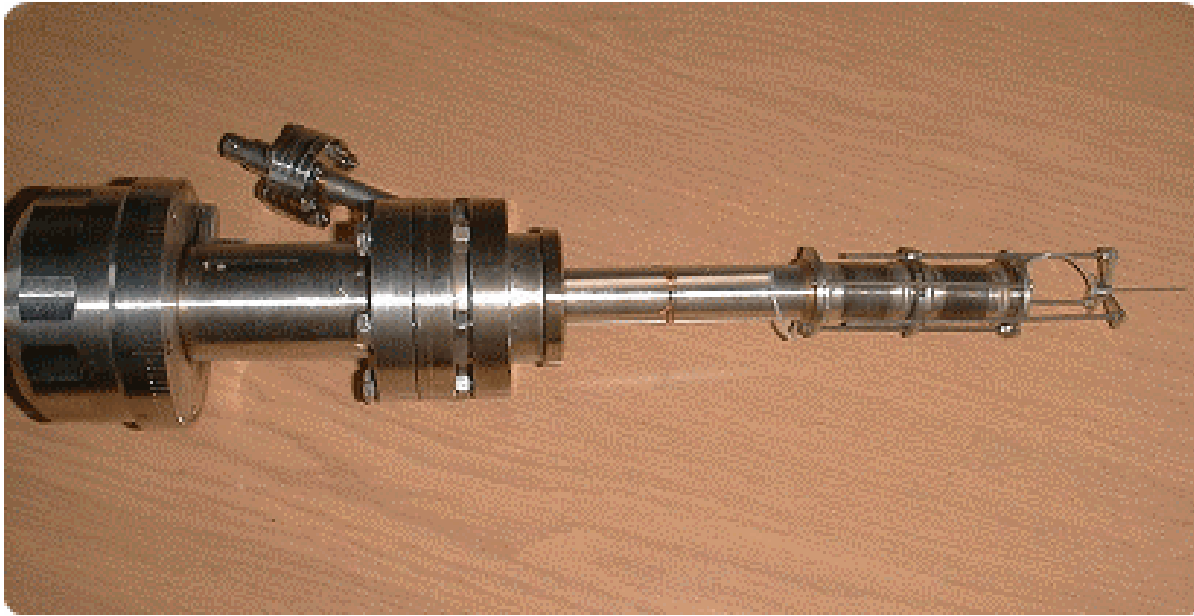
UPS and *XPS*



- X-Ray Source (Mg K_{α} / Zr $M\zeta$)
- UV Lamp (He I / He II)
- Lens System: 5 operation modes
- Angle Resolved Hemispherical Analyser
- Detector (Channeltron)
- Data acquisition system



Kelvin Probe set-up

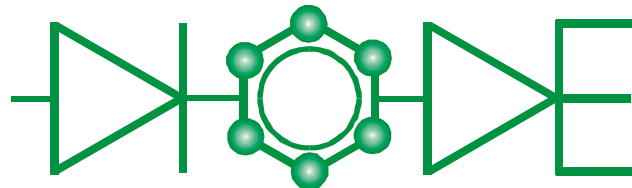


◆ calibration over spacing dependence

➡ plane paralel capacitor geometry

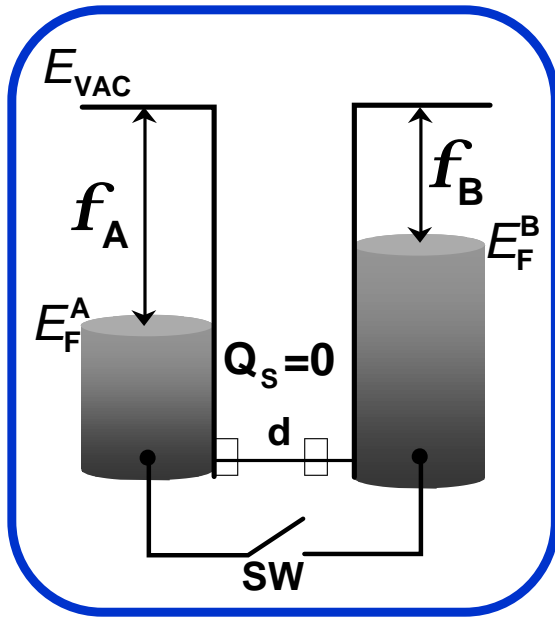


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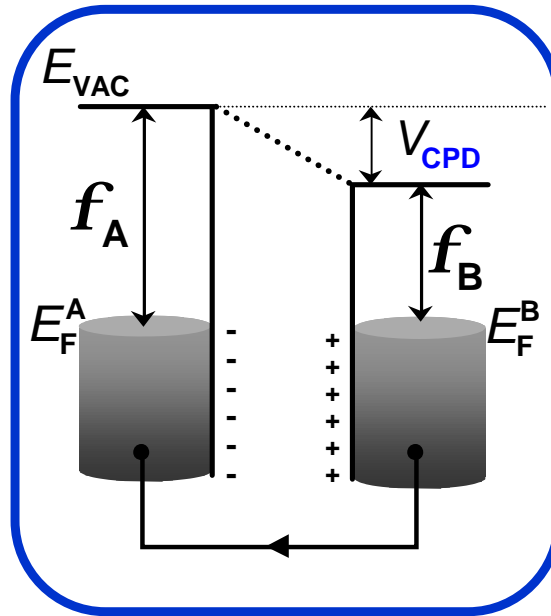
Determination of **electronic properties** by means of **Kelvin Probe Method**



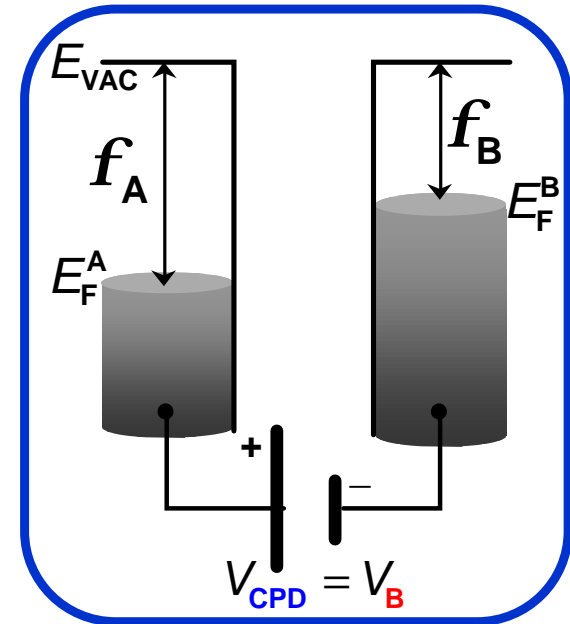
$$C_K(t) = C_0 (1 + k \cos wt);$$

$$d(t) = d_0 (1 + \sin wt);$$

$$k = \frac{d_1}{d_2}; \quad C_0 = e_0 e_r \frac{A}{d_0};$$



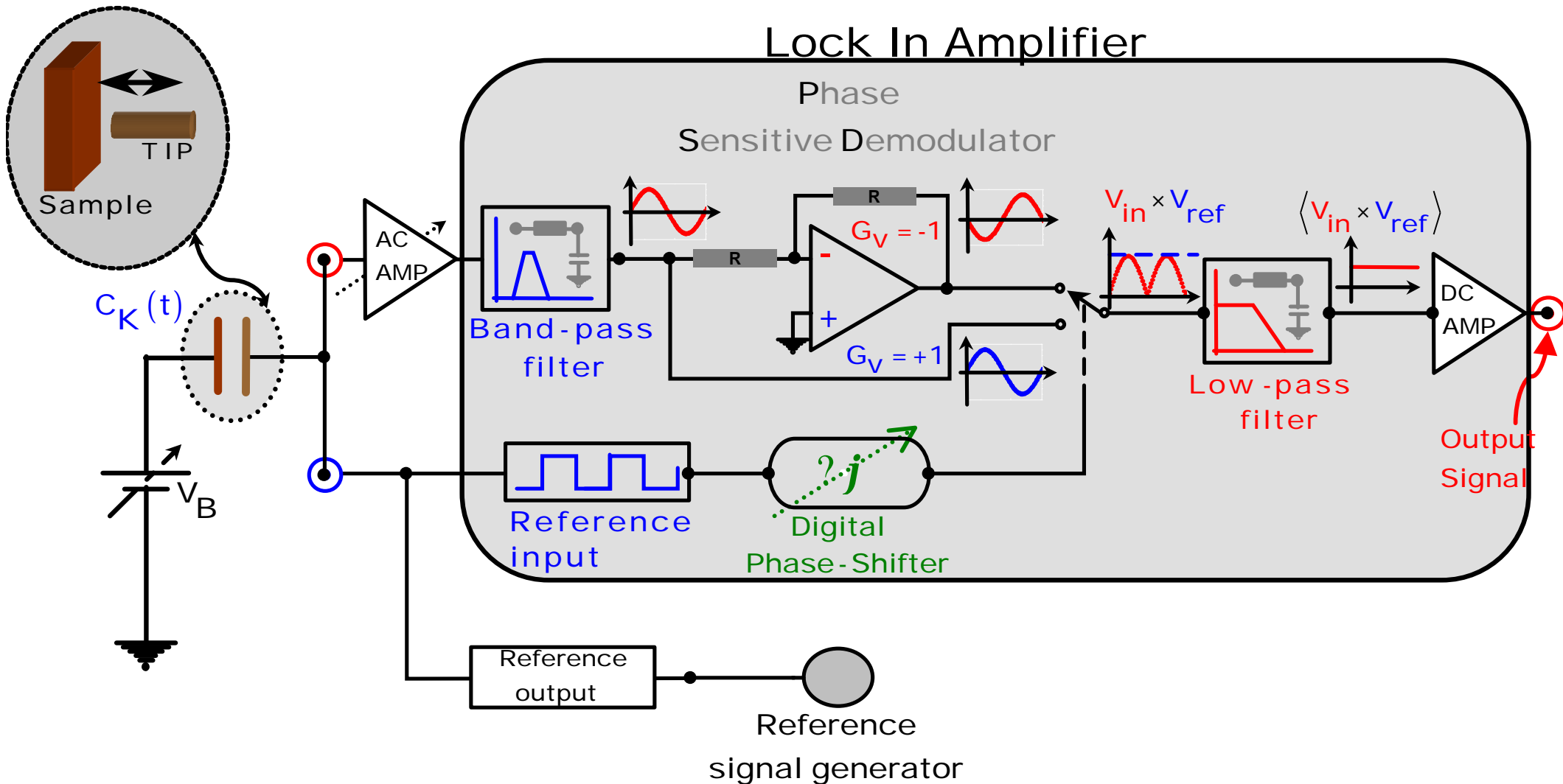
$$V_{CPD} = (f_B - f_A) / e$$

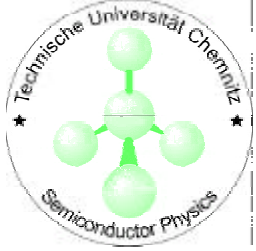


$$C_K(t) = \frac{e_0 A}{d(t)} = \frac{Q(t)}{V_{CPD}};$$

$$i_{tot}(t) = \frac{dQ(t)}{dt};$$

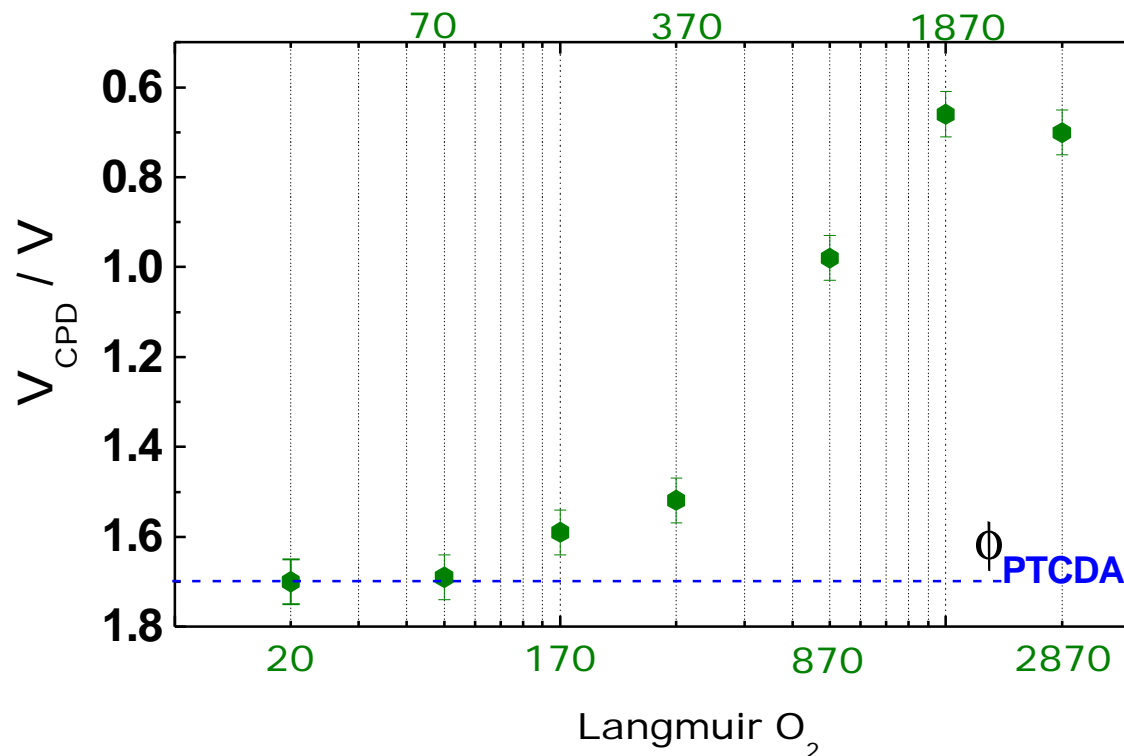
Kelvin Probe Method





Oxygen exposure effect on **PTCDA/S-GaAs(100)** surfaces

- measurement performed on **PTCDA/S-GaAs** surfaces shows significant changes



➤ strong change in contact potential difference

with increasing oxygen exposure

⇒ change in work function

➤ shift of Fermi level with in the gap

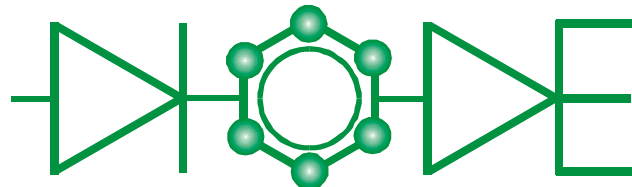
➤ change in ionisation energy

➤ two mechanisms can help to explain:

- formation of surface charged layer
- oxygen induced traps on to organic layer

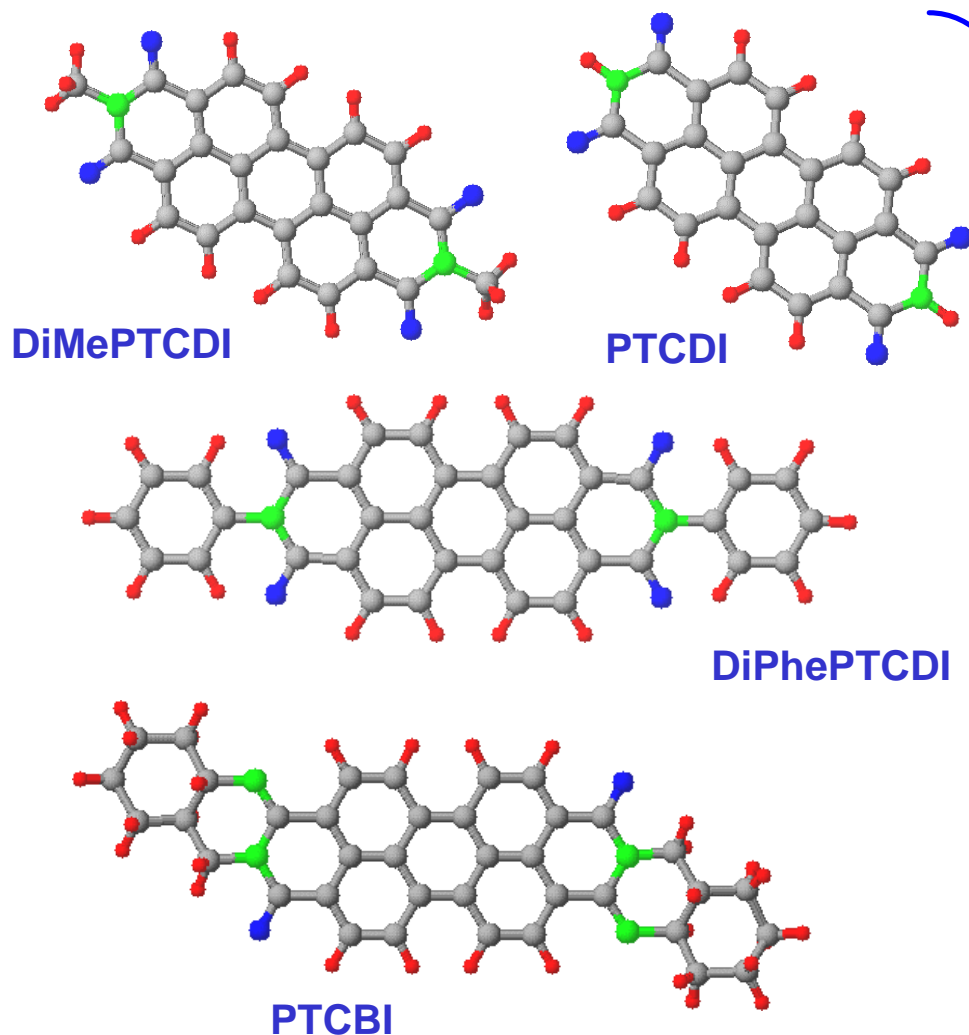


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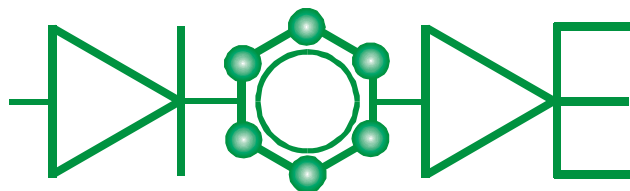
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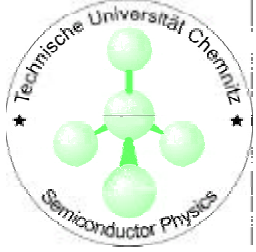
OUTLOOK



Perylene Derivatives

- further investigations of other perylene materials under different conditions (e.g gases) in order to understand their related changes and to optimise the devices based on such organic materials



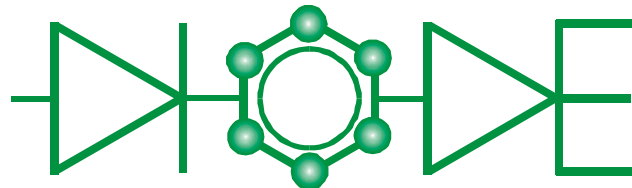


Personal opinions

- as PhD student :
 - ✓ weekly meetings for discussing latest results and thus new ideas and hints are given also knowledge about other techniques are improved
 - ✓ good atmosphere in the group
 - ✓ good help for setting up and/or mastering the techniques
 - ✓ training discussions
 - ✓ participations at international and national conferences are encouraged
- as Diode Young Researcher :
 - ✓ opportunities to meet other groups and exchange informations in any field is a big benefit
 - ✓ experiences such as Bessy II and DIODE STM/AFM Workshop prove to be very instructive
 - ✓ discussions via Internet or on the internal web site still can be improved



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