ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday 29 March 2007
17:00-18:00

3rd Floor Seminar Room

"Diamond – A New Semiconductor Material for Life Science Applications"

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ABSTRACT

Diamond possesses many outstanding properties like its mechanical hardness and chemical inertness. Quasi-metallically doped with boron it is the only inert and corrosion resistant electrochemical electrode material for harsh environment not being a noble metal. It is a wide bandgap semiconductor and thus able to serve as basis for field effect transistor structures, operating in the liquid as ChemFETs. Todays biochips are Si-MOSFET based with metal oxide active electrodes, however with limits in corrosion resistance and biocompatibility, for example when in contact with blood. Thus future biochips may well be carbon based, diamond being the ideal case. However diamond does not possess a natural substrate and single crystal material is only available in chip size at present. Large area diamond thin films are usually nanocrystalline, containing a large amount of grain boundaries. Single crystal chips are therefore used in proof of concept experiments, while nanodiamond is the industrial workhorse like in DNA chips and cell chips.

In this talk the basic electrochemical properties of the diamond surface depending on its termination will be introduced. In comparison to noble metals water dissociation is suppressed over a large potential range, generating a unique window for electrochemical analysis. The talk will then focus on the electrode and ChemFET behavior, especially under highly corrosive conditions. New features not possible with a MOSFET device structure only related to the diamond surface will be highlighted. High analytical sensitivities can be obtained due to very low background currents, also allowing to realize nanoelectrode arrays of extreme sensitivity. Finally, diamond will be discussed as basis for DNA and cell chips.