ERATO
Someya
Bio-Harmonized Electronics

ERATO SEMINAR

Sponsored by JST ERATO Someya Bio-Harmonized Electronics Project

東京大学 THE UNIVERSITY OF TOKYO

Field effect devices based on organic compounds of interest for electronic and sensing applications

Professor Antonio Cassinese

CNR- SPIN and Dipartimento di Fisica Università Napoli Federico II

Date & Time: February 10th (Tue) 2015, 13：00 - 14:00

Place: Meeting Room 250, Engineering Bldg #10, 2F, Asano Campus, The University of Tokyo

浅野キャンパス　工学部新 10 号館 2 階　会議室1（部屋番号 250）（文京区本郷 7−3−1）

ABSTRACT: In this talk, I will summarize the most significant results that our group in Naples has recently achieved investigating the properties of innovative conjugated organic compounds. Our experimental activities have been mostly dealt with the fabrication of N-type organic field-effect transistors (OFET) based on Perylene diimide molecules functionalized with cyano groups (namely, PDI8-CN_2 and PDIF-CN_2). These oligomers have been deposited in form of thin films by using both conventional (OMBD) and Supersonic (SuMBD) Molecular Beam Deposition techniques. The related structural and morphological properties were deeply investigated by AFM, XRD techniques and synchrotron radiation experiments as a function of the basic deposition parameters including different substrates. The charge transport and trapping phenomena occurring in the fabricated OFET were characterized in various environmental conditions (i.e. air, vacuum, water) using both DC and AC measurements and STM-BEEM technique. In particular, a close attention was paid to investigate the so-called Bias-stress phenomenon affecting these devices by comparing the results with that obtained by considering OFET based on PDFICN_2 single crystal. Our main outcomes can be summarized as follows: a) Fabrication of high mobility (μ=0.2 cm^2/volt*sec) n-type OFET by depositing films on SiO_2 substrates kept at room temperature; b) Identification of basic charge-trapping electrochemical mechanisms ruling the Bias Stress effect in n-type OFET; c) Demonstration of the capability of PDIF-CN_2 OFET to work steadily even in liquid environment.
In the second part of the talk, I will focus on a more recently started activity related to the realization of Organic electrochemical transistors (OECTs) based on PEDOT-PSS. In this field, in particular, we are analyzing the response of OECTs when the active channel is in contact with liquids containing Dopamine or complex surfactant-salt mixtures. The results obtained could pave the way to the development of a new class of devices suitable for the in-situ monitoring of substance and morphological transitions involving micellar aggregates. The last part of the talk will be dedicated to illustrate the future activities concerning the realization of devices with reduced dimensionality (1D or nanodevice) of interest for the investigation of physical fundamental aspects and the framework and the main goals of the ongoing EOS project, dealing with the development of organic logic circuits.

Biography: From the 2002 he was a permanent Researcher at the University of Naples, Faculty of Engineering, Physics Department. Actually he is Associate Professor and in 2014 he got the italian habilitation for full professor position in experimental condensed matter physics. The scientific activity carried out concerned the investigation of the d.c. and r.f electrical properties of superconductive materials, oxides, organic (polymer) and inorganic organic hybrids (I/O) looking both to the understanding of physical fundamental aspects and possible practical applications in the electronic fields. Firstly, it has been focused the optimization of various techniques concerning realization of superconductive thin films and the study of the electrical properties in the microwaves region (1-100GHz). From an applicative point of view the attention have been focused on the superconducting cavities for particle accelerators and the realization of passive microwave devices (filters, antennas, duplexer) of interest for mobile satellite application. Since 2004, the activity has regarded the realization of field effect devices (FET) based on superconductive films and the study of organic materials and hybrid inorganic organic devices and materials for electronic application (mainly FET, Memories, spin-valve) focusing the attention on both DC and AC (10Hz -1GHz) electrical properties investigated as a function of temperature (4-400K). A Part of the activity, has been dedicated to the realization of microchannels and microdevices (Lab-on-chip) based on PDMS for the study of pathologies of red blood cells.

Contact: Professor Takao Someya (Email: someya@ee.t.u-tokyo.ac.jp, Phone: 03-5841-0411)