Institute for Microelectronics and Microsystems

AT2 Technological Area Characterization

WEBINAR: IMM CHARACTERIZATION TOOLS

GIOVEDI' 12 MAGGIO 9:30-12:00
https://meet.goto.com/799241029

ORE 9:30 *INTRODUCTION, Valentina Mussi*

ORE 9:35 *MULTI-TECHNIQUE EQUIPMENTS, CHAIR Francesco Ruffino*

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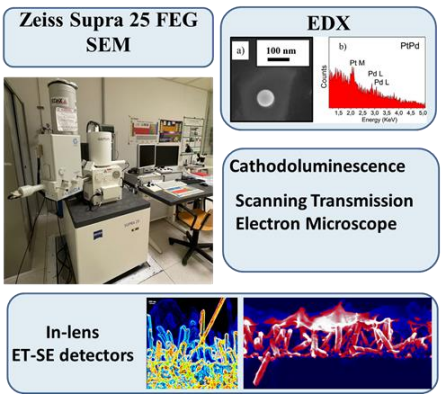
"Morphological, chemical and optical characterization with the multipurpose SEM@IMM- Catania Unit"

Undoubtedly, the Zeiss Supra 25 FEG-Scanning Electron Microscope (SEM), located at IMM-Catania Unit, **cannot be considered a state of the art microscope** because its installation dates back to more than 15 years ago. However, the continuous maintenance and upgrading, combined with a constant training for new users, make it one of the most utilized technique in our labs which, nowadays, allows the publication of more than 15 papers per year. Indeed, it has proved to be an essential tool to characterize materials for applications spanning from sensing to water treatment and power electronics, or as alternative nanofertilizers.
Conventional SEM imaging is usually employed to investigate the morphology of oxides (such as TiO2, ZnO- based nanomaterials) and metallic nanoalloys and to conduct quantitative analyses of extended defects in SiC. Interestingly, the Gemini **Scanning Transmission Electron Microscope** detector allows a low energy inspection of polymeric nanocomposites avoiding e-beam induced damage and metallization. These analyses are often combined with **Energy Dispersive X-ray Spectroscopy** to map chemical components, and with the latest installed **Catodoluminescence** system to map the optical activity (visible light emission) of individual ZnO nanorods or point defects in SiC.



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ORE 10:10 *SYSTEMS FOR DYNAMIC STUDY OF STRUCTURAL, OPTICAL, ELECTRICAL PROPERTIES, CHAIR Fabiola Liscio*

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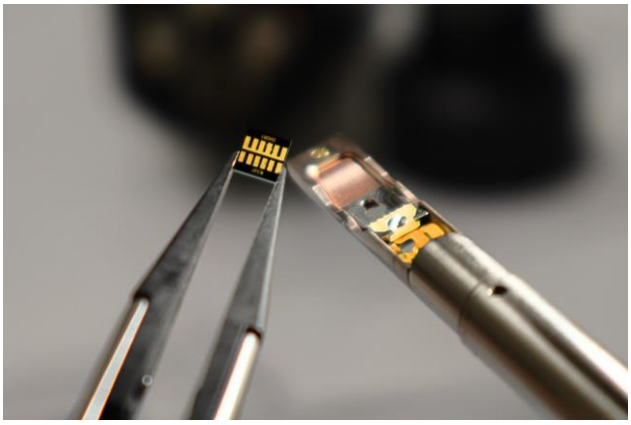
"In-Situ TEM: transition from static to dynamic in nanoworld observation"

Transmission electron microscopy has made giant steps in recent years, allowing us to reach ever higher resolutions thanks to the advent of significant instrumental innovations, such as spherical aberration correctors that have definitely change the paradigm. Its use, however, remains generally restricted to morphological, structural and elemental characterization of solid samples thin enough to allow the passage of electrons and stable in high vacuum conditions. However, analyses of samples under different conditions, such as samples in liquid or controlled atmosphere, and the study of samples subjected to external stimuli are typically excluded.
The recent flourishing of MEMS technology (micro electro-mechanic systems), and the simultaneous development of special TEM sample holders suitable to support this technology, laid the foundations for new and incredibly wider possibilities of application of so-called in-situ microscopy.
As the name itself says, this technique not only allows to observe at the nanoscale a dynamic system in evolution, such as a solution, but also allows to provide stimuli such as a temperature or potential variation, both in vacuum and in liquid, and observe live what these stimuli do to the sample being observed. In particular, for liquid analysis systems, the use of a closed and modular cell set up, based on special MEMS chips, allows to observe phenomena such as particle growth, electrochemical reactions and more, in a modular pressure system. The possibilities offered by the in-situ technique are obviously not infinite, the difficulties are many, but the starting point offers countless ideas for the near future research.



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ORE 10:50 *IN-HOUSE CUSTOMIZED SYSTEMS, CHAIR Antonietta Taurino*

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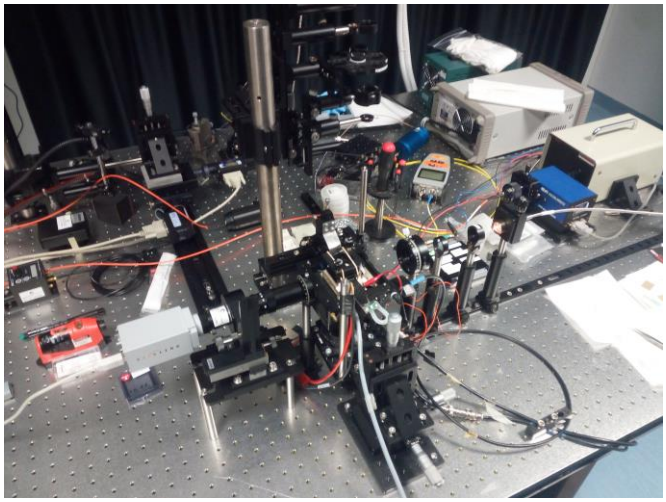
"***Set-up for the study of the dynamics of charge carriers in semiconductor devices and the internal electric field distribution"***

The set-up enables the measurement of current/charge transients induced by optical pulses in radiation detectors up to the ns timescale thus allowing us to extract electrical properties like the carrier mobility. The use of a supercontinuum laser allows to choose the excitation wavelength (pump beam) which results in a flexibility in the investigated material and/or spectral studies. When used with materials exhibiting linear electro-optical effect (Pockels effect) like the zincblende structures, the same set-up allows the investigation of the internal electric field distribution under stationary or dynamic conditions. To this scope an optical transmission configuration with crossed polarizers is used with a probe beam of proper wavelength. For detection, both VIS/NIR cameras, a linear camera, or fast photodetectors can be employed, depending on the specific interest. The two different measurements can be performed simultaneously. Application to CdTe radiation detectors will be presented and the possibilities offered by the set-up for novel studies of electro-optical devices will be highlighted.



ORE 11:20-12:00 *FREE DISCUSSION, QUESTIONS, PROPOSALS, CHAIR Valentina Mussi*