XXXV Panhellenic Conference on Solid State Physics and Materials Science

September 26-29, 2021
Virtual Conference
http://xxxv-ssm.inn.demokritos.gr/

School on

Materials Characterization Techniques

Sunday 26th September 2021

11:00	**Opening** **Athanassios Kontos** National Technical University of Athens
11:00 -12:45	**Electron Microscopy** **Dr Nikolaos Boukos** Institute of Nanoscience and Nanotechnology, NCSR "Demokritos" **Dr Elias Sakellis** Institute of Nanoscience and Nanotechnology, NCSR "Demokritos"
12:45-13:45	Lunch Break
13:45-15:30	**Optical Spectroscopy** **Assoc. Prof. Athanassios Kontos** School of Applied Mathematical and Physics Science, National Technical University of Athens **Prof. Ioannis Raptis** School of Applied Mathematical and Physics Science, National Technical University of Athens
15:30-16:00	Coffee Break
16:00-17:45	**Materials characterization using surface sensitive techniques** **Prof. Stella Kennou** Department of Chemical Engineering, University of Patras
18:00	**Closing** **Athanassios Kontos** National Technical University of Athens

DEMOKRITOS

XXXV Panhellenic Conference on Solid State Physics and Materials Science

September 26-29, 2021
Virtual Conference
http://xxxv-ssm.inn.demokritos.gr/

SPEAKERS

Dr Nikolaos Boukos
Institute of Nanoscience and Nanotechnology,
NCSR "Demokritos" (GREECE)

Nikos Boukos is Director of Research in the Electron Microscopy and Nanomaterials Laboratory, Institute of Nanoscience and Nanotechnology, National Center for Scientific Research "Demokritos". He obtained his Physics degree (1985) and PhD (1992) from Aristotle University of Thessaloniki. His research interests include application of Transmission and Scanning Electron Microscopy (TEM, S/TEM, SEM) and relevant analytical techniques such as Electron Energy Loss Spectroscopy (EELS) and Energy Dispersive X-ray Spectroscopy (EDS) for the study and optimization of a wide range of materials and nanostructures. He is also involved in the growth, characterization and properties of ZnO nanostructures. He has published more than 220 scientific articles, acquiring more than 5500 citations (h factor 38).

Assoc. Prof. Athanassios Kontos
School of Applied Mathematical and Physics Science,
National Technical University of Athens (GREECE)

KONTOS Athanassios, G. Assoc. Prof., Phys. Dep. School of Applied Mathematical and Physical Sciences, NTUA, and Collaborative Researcher in the INN, NCSR 'Demokritos'. Diploma in Physics (1989, Un. of Athens) and Ph.D. in Physics (1994, University of Warwick, UK)
His Research Interests include Dye sensitized and perovskite solar cells, materials properties as well as optimization of device efficiency and stability - photocatalysis and superhydrophilicity of TiO_2 materials - CO_2 capture and conversion. Synthesis of TiO_2 (nanoparticles, nanotubes, dyes sensitized, quantum dots) and related modification (anion doping, functionalization with metals and carbonaceous materials). Structural (Raman spectroscopy), electronic (photoluminescence), optical (UV-vis.) and morphological (SEM, AFM) characterization of semiconducting nanomaterials and films, including perovskite halides.
Email: akontos@mail.ntua.gr Website: users.ntua.gr/akontos/ Phone: +30-210-772-3014

Prof. Stella Kennou
Department of Chemical Engineering,
University of Patras (GREECE)

Stella Kennou is a professor at the Chemical Engineering Department, Surface Science Laboratory, of the University of Patras , Greece. Her Research interests are in Solid State Surface Physics and Chemistry using

surface science experimental techniques (XPS, UPS, AES. ELS, LEED, TDS, SEXAFS, Work Function measurements), Spectroscopic characterization of solid surfaces and interfaces of materials, thin metallic film / semiconductor interfaces, organic/ inorganic and organic/organic electronic structure interfaces for organic electronic applications, Interaction of metals and gases on metallic and semiconducting surfaces. Also in Surface characterization of the atomic and electronic structure of carbon based materials, high –k oxides thin films and rare earth metal oxide thin films prepared with various methods for microelectronic device applications by surface science experimental techniques. She has co-authored over 180 peer reviewed publications in qualified international journals.

Prof. Yannis Raptis
School of Applied Mathematical and Physics Science,
National Technical University of Athens (GREECE)

RAPTIS Yannis S., Professor, Phys. Dep., School of Applied Mathematical and Physical Sciences, NTUA
Diploma in Physics (1981, Un. of Athens), Ph.D. in Physics (1988, NTUA) **Research Area:** Optical Spectroscopy of Condensed Matter
His Research Interests include Spectroscopic study (Raman, Luminescence) mainly of semiconducting materials of the groups IV (Si, Ge, SiC), III-V (GaAs, InP, InSb, AlSb, GaP) and II-VI (CdTe, CdZnTe), in bulk and in low-dimensional forms, in variable Temperature and Pressure conditions, a-Si and nc-Si under laser-annealing conditions.
E-mail: yraptis@central.ntua.gr, Website: users.ntua.gr/yraptis/ Phone: +30-210-772-3044

Dr Elias Sakellis
Institute of Nanoscience and Nanotechnology,
NCSR “Demokritos” (GREECE)

Dr. Elias Sakellis received his Ph.D. degree from the Department of Physics, University of Athens. Since then he works as associate researcher at the Institute of Nanoscience and Nanotechnology of the National Center for Scientific Research DEMOKRITOS, Athens, Greece and at the Condensed Matter Physics Section of the department of Physics of the University of Athens. His current research interests include electron microscopy, synthesis of nano-structured materials with E-beam PVD, chemical and electrochemical methods as well as the study of their structural, electrical and optical properties. He is the author of more than 60 research papers with more than 600 citations. He has extended experience in electrical measurements of various materials, as well as, an expertise in structural, crystallographical and electronic configuration characterization of nanostructures -including nanoparticles- with scanning electron microscopy (SEM), transmission electron microscopy (TEM) and X-Ray Diffraction (XRD).

XXXV Panhellenic Conference on Solid State Physics and Materials Science

September 26-29, 2021
Virtual Conference
http://xxxv-ssm.inn.demokritos.gr/

Syllabus

Electron Microscopy

During the last decades Electron Microscopy has proven itself to be the "workhorse" of materials characterization. It is a direct imaging technique allowing us to study materials and nanostructures at the micro-, nano- or even the atom- scale. Scanning Electron Microscopy (SEM) use an electron beam to scan the surface of a material, while in Transmission Electron Microscopy (TEM) the electron beam is transmitted through a thin part of the material allowing us to study its interior. These techniques enable us to study the morphology, structure and chemical composition of materials and nanostructures in order to develop new ones and optimize their properties.

Optical Spectroscopy

Interaction of Electromagnetic Radiation with charge carriers– Optical Characterization of bulk and low dimensional materials (A.G. Kontos)
This presentation will focus on general concepts of optical spectroscopy: Dielectric Functions – Refractive Index – Absorption Coefficient, Direct – Indirect Energy Band Gap, Direct – Indirect Excitonic Absorption, Piezo-Birefrigence as well as description/examples of relevant spectroscopic techniques applied to low-dimensional materials: Photoreflectance and Electroreflectance, Ellipsometry, Photoluminescence spectroscopy and Transient Absorption and photoluminescence spectroscopies.

Interaction of Electromagnetic Radiation with collective excitations - Infrared and Raman spectroscopies in the study of Materials and Devices (Y.S. Raptis)
This presentation will present the fundamental of vibrating spectroscopies: infrared and Raman with classical and quantum description as well as Selection Rules in Raman due to symmetry, Raman scattering and polarization properties, Resonance Raman effect and Experimental Techniques – Spectrometers. Many examples of characterization on carbon materials, semiconductors, heterostructures and devices will be presented, too.

Materials characterization using surface sensitive techniques

Solid surfaces and interfaces are important in a number of modern technological applications from microelectronics to nanomaterials and heterogeneous catalysis. The quantitative and qualitative chemical composition of the first atomic layers, the crystal structure of solid surfaces, as well as the study of different interfacial electronic structures which are strongly related with material behavior can be determined by using a number of surface sensitive experimental techniques. Interfaces of semiconducting and insulating oxides are widely used in microelectronic applications, especially as gate oxide layers and in photovoltaic devices, to prevent electron-hole recombination. Interfaces are affecting the leakage currents and the gate capacitance in MOSFET arrays, as well as the electron and hole diffusion in solar cells. The principle of operation as well as the experimental apparatus of the most used experimental techniques like the photoelectron spectroscopies, will be presented. Some characteristic examples will be also discussed.