

**A Global Initiative of Academic Networks (GIAN) Course on
Scanning and Transmission Electron Microscopy: basics and applications
to low dimensional structures**

3rd -7th December, 2018 at Anna University, Chennai

Overview

Nowadays, the advanced discovery and development of nanometric-scale-structured materials with innovative properties requires investigation techniques able to perform characterizations down to the atomic scale. The modern transmission electron microscopes (TEM) are now able to accomplish this feat. The main reason for the use of the electron microscope resides in the superior resolution it allows due to the very small wavelength of the electrons that, depending on the accelerating voltage V , varies in the range 4-0.3 pm, many orders of magnitude smaller than the visible light wavelength (400-700 nm). However, it is worth using electrons for many good reasons other than the extraordinary capability of imaging individual atoms in a lattice: when they interact with matter, they produce a wide range of secondary signals, giving the materials scientists a lot of details on the examined samples. Among these, information can be obtained on the crystal lattice parameter, the crystal structure, presence of ordering or different phases, defect nature and distribution; more importantly, chemical information from nanometric regions of the specimen with atomic resolution. Scope of this short course is to introduce to the principles of the microscope operation, fundamentals of the interpretation of the diffraction, the phase contrast and to TEM-related techniques, with special attention to the so-called Z-contrast imaging obtained in the Scanning mode. Several emblematic applications to low dimensional structures will be presented to show the possibilities of these techniques and the problems they can solve.

Objectives:

The primary objectives of the course are as follows:

- i) Introducing the participants to the basic of the scanning and transmission electron microscopy
- ii) Presenting fundamentals and interpretation of the different contrast mechanisms, and related simulations
- iii) Introduction to some electron microscopy high resolution analytical techniques
- iv) Reviewing several applications to low dimensional materials, especially semiconducting and metal-oxides
- v) Providing the participants a methodological approach for the solution of materials characterization

Duration Course Code & Venue	Date: 3 rd -7 th December, 2018, Course Code: 176020B07, Venue: Crystal Growth Centre, Anna University, Number of participants for the course is limited to hundred.
Modules	Introduction to the importance of the EM techniques in Materials Science, Basics of Operation: lenses, defects, Scanning versus Transmission mode Diffraction contrast in TEM images: The diffraction pattern, Two-beam condition, Defects imaging, Chemical sensitive imaging Phase contrast: Principles of the phase contrast, High Resolution Electron Microscopy, The importance of simulations Related techniques: Scanning TEM (Z-contrast), X-ray microanalysis, Energy Loss Spectroscopy, Cathodoluminescence Applications: Defects and compositional contrast in strain-balanced InGaAs multi quantum wells. Combining diffraction contrast and lattice fringes analysis, The identification of new crystal phases by means of the STEM-HAADF technique, High resolution cathodoluminescence spectroscopy on single nanostructures
You Should Attend If...	<ul style="list-style-type: none"> ▪ You are a student (B.Tech/M.Sc/M.Tech/PhD), a post-doctoral fellow ▪ Faculty from reputed academic institutions and technical institutions. ▪ Executives, engineers, researchers from manufacturing, service and government organizations including R&D laboratories
Fees	Participants from abroad : US \$500; Industry/ Research Organizations: Rs. 5000; Academic Institutions: Rs. 2000 (Faculty), 1000 (Research Scholars/PG and UG Students). The above fee includes all instructional materials. The participants will have to take care of their travel, accommodation and food.

The Faculty



Dr. Laura Lazzarini is a Research Scientist at the Institute of Materials for Electronics and Magnetism of the National Research Council of Italy (IMEM-CNR) formerly *MASPEC*. **Dr. Laura Lazzarini** is the Coordinator and Scientific Responsible of the IMEM Unit Research (eleven researchers) “Study and development of Nanosystems” and IMEM scientific person in charge for a number of scientific projects.

She is a microscopist with nearly 30 years of experience in transmission and scanning electron microscopy, and cathodoluminescence mainly applied to semiconducting low dimensional structure. In particular she has been investigating the role of strain and the study of extended defects generation in the mismatched heterostructures, and the correlation between the structural and optical properties of the materials. Most of her activity is devoted to the methodological development and application of advanced analytical and high resolution electron microscopy techniques to the study of nanosystems for opto- and nano-electronic applications, photonics, catalysis and gas-sensing.

She is author of more than 180 papers on international journals, 1 review for Encyclopedia and author of 6 book chapters. She has also delivered 6 invited talks and is an expert evaluator of the UE for reviewing research projects in H2020. She also acts as project evaluator for the Austrian Science Fund (FWF).



Dr. Sasikala Ganapathy is an Assistant Professor at Crystal Growth Centre, Anna University, Chennai. Her area of specialization includes *Quantum dots, Optoelectronic Materials, characterization and device Fabrication*.



Dr. Shubra Singh is an Assistant Professor at Crystal Growth Centre, Anna University, Chennai. Her area of expertise includes *Functional materials; Brownmillerites; Materials for energy applications, CO₂ capture and photocatalysis*

Course Co-ordinators

Dr. Sasikala Ganapathy

Assistant Professor
Crystal Growth Centre,
Anna University, Chennai-25.
Phone: 044 2235 8350
E-mail: sasikala_ganapathy@yahoo.co.in

Dr. Shubra Singh

Assistant Professor
Crystal Growth Centre,
Anna University, Chennai-25.
Phone: 044 2235 8351
E-mail: shubra6@gmail.com