NANOSCIENCE AND NANOTECHNOLOGY PROGRAM

Miguel García-Rocha, PhD

Research Interests

- Semiconductors
- II-VI based nanostructures
- Bioceramics
- Optical properties of semiconductors
- Ultrafast spectroscopies
- Time resolved photoluminescence

Dr. García-Rocha is Professor in the Department of Physics and member of the Nanoscience and Nanotechnology PhD. Program at Cinvestav. He completed his MSc and PhD at the Physics Department, Cinvestav, Mexico. He did post-doctoral training at the Institute of Semiconductors, Linz University, Linz, Uper Austria, Austria, in the laboratories of Dr. Helmut Sitter. During this time he developed a deep interest for in-situ Reflectance Difference Spectroscopy during MBE growth of II-VI based semiconductors. In 1996, he accepted an offer for a PI position at Cinvestav, Mexico City. Dr. García-Rocha is author of more than 30 publications that received approx. 300 citations. Dr. García-Rocha has received independent grants to develop his own unique lines of research on investigating the optical properties and time resolved photoluminescence of II-VI based epitaxial films and nanostructures. To that purpose, Dr. García-Rocha received grants from Conacyt (Mexico) in order to implement the Laboratory of Ultrafast Spectroscopies, the first of its class in Mexico. Time Resolved Photoluminescence, Two Photon Absorption and Pump and Probe spectroscopies are some of the experiments that are performed at his laboratory.

Selected Honours and Awards

- OÄD Postdoctoral Fellow Award 1996-1997
- Conacyt Posdoctoral Fellow Award 1997-1998

Selected Funding

- Conacyt

Research Projects: Ultrafast spectroscopies on semiconductors. Bioceramics

The main interest of my laboratory on ultrafast spectroscopies has been the study and understanding of the carrier recombination and carrier dynamics in II-VI based semiconductors and semiconductor nanostructures. To that purpose, several techniques have been implemented, in order to measure the evolution of the light emitted by a sample, under excitation of ultrashort laser pulses. Autocorrelation, analysis of the FWHM, interferometry and Time Resolved Photoluminescence (TRPL) have been applied on intrinsic and doped epitaxial films, ultrathin quantum wells (UTQWs) and ternary alloy based quantum wells (QWs). Experiments are performed in the 3 to 300 K temperature range, by using femtosecond and picosecond laser pulses in the IR and UV-Vis regions. Through these experiments, we have determined the radiative and non-radiative mechanisms involved in the carrier relaxation and recombination and their correlation with the structural and optical properties of ZnSe, ZnSe:Cl, CdSe/ZnSe UTQWs and ZnCdSe/ZnSe QWs. In collaboration with other groups, TRPL has been applied to Cu_2O nanostructures, and luminescent materials. Experiments on the temporal dispersion of a pulse of light are under preparation in order to determine the particle size and optical properties of nanoparticle colloidal systems. Additionally, Transient Thermo Reflectance Spectroscopy applied to semiconductor materials is under preparation.

Another project of interest, which is developed in collaboration with Dr. M. Méndez from Escuela Superior de Física y Matemáticas at IPN, is the development of nanostructured bioceramics and their application as coatings for metallic implants, ophthalmological implants, diagnose and drug delivery for medical use. Depending on the final application, different synthesis methods are employed. The structural, mechanical and chemical properties are analyzed through different techniques and biocompatibility tests are also done.