My Research Fields

1. Current interests:

Novel research programs aiming at:

i) nanoscale substrate engineering (using ultra high purity silicon) as a support for challenging new semiconductors (nanotubes, quantum dots,…),
ii) nanoscale bio-sensors based on carbon nanotubes (CNT),
iii) Nanoscale optical characterization of semiconductors as well as biomaterials using novel approaches associated with NSOM,
iv) nanostructures including «Directed Self-Assembled Systems» for Quantum Devices,
v) nanoscale and atomic patterning,
vi) nanoscale Processing including "Controled Nucleation", "Doping of Quantum Devices". This requires structural and chemical control of Point Defect agglomeration in semiconductors using 200 keV HRTEM equipped with Z-Contrast, and EELS, and ELNES.

Other current research on:

i) "Atomistic Engineering" which includes (i) modeling, characterization and manipulation of point defects in high purity materials, (ii) quantum chemistry and thermodynamics of defects and (iii) ultra fast and high temperature phenomena driving phase transformations in solid phases,
ii) Binary and ternary high-k gate dielectric,
iii) Silicon heterostructures SiGe, SOI,
iv) Modeling and numerical simulation of defects in nitrogen doped Czochralski and Float Zone silicon,
v) Nanoscale characterization of stress and carrier lifetime in silicon using novel modes of Near Field Scanning Microscopy,
vi) Nanoscale mechanical properties of ultra high purity silicon via Nanoindentation and load controlled nano-scratches,
vii) Gettering of impurities and denuded zones formation in N doped ultra high purity silicon,
viii) Simulation of "Ion implantation" spike and rapid thermal annealing.

2. Past Research Fields:

i) Characterization of charge carriers by «Light Beam Induced Current» and «Electron Beam Induced Current».
ii) Microwave Photoconductance Decay and Injection Level Spectroscopy of impurities in silicon.
iii) Lifetime measurements for characterization of generation and recombination centers and traps in silicon,
iv) Surface passivation for lifetime measurements,
v) Fabrication and characterization of low cost solar cells based on polycrystalline silicon.
vi) Physical and numerical simulation of multiple gettering of solar grade materials,
vii) Passivation of surface defects in silicon,
viii) Thin film optical properties,
ix) Surface modification for photovoltaic applications (anisotropic wet etching and antireflective coatings),
x) Fabrication and characterization of non homogeneous semiconductor materials: granular silicon thin films, porous silicon, screen printed ITO,[1]
xi) Fabrication of thin film solar cells CdS/Cu_2S.
xii) Automation of solar cell batch processing and data sampling on local network and data analysis.

[1] **ITO**: Indium Tin Oxide: transparent and conductive / semiconductor material