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Millimetre and sub-millimetre wave GaAs Schottky diodes, detectors and mixers (M3GAAS)

Project Coordinator: IMT Bucharest; Contact person: Dr. Alexandru Muller, alexandru.muller@imt.ro;

PROJECT GOAL

The aim of this project is **to obtain Schottky diodes with a cut-off frequency as high as possible (but higher than 3 THz) and to demonstrate their functionality in a millimeter wave frequency direct video type receiver as well as in a mixer structure working at 100 GHz. At 100 GHz frequency the devices and circuits can be fully characterized in our labs.**

CHALLENGE

- Advanced nanolithographic processes to obtain Schottky diodes with an area smaller than 1µm² manufacturing very thin self-sustainable GaAs membranes supporting the circuits.
- Design, modeling and manufacturing of the monolithic integrated direct receiver structure
- Nonlinear analysis and optimization of the 100 GHz harmonic mixer structures.

Consortium members:

- **National Institute for Research and Development in Microtechnologies, IMT Bucharest,** www.imt.ro;
- **S.C ROM-QUARTZ S.A, Partner team leader: Sauca Benoni,** bsauca@minatech.ro, www.minatech.ro/romquartz;

December 2013 -September 2016

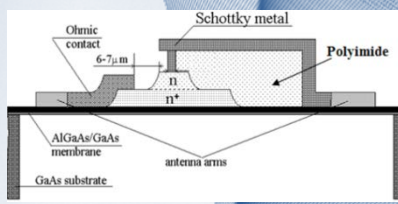
Implementation status of the project/Results

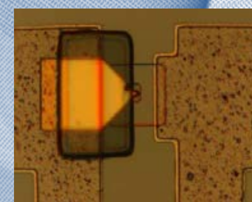
- **Proposed solution Polyimide bridge Schotky diode area <1 µm²** - *Work in progress*

Chalenges; Possible topologies

- nanolitho on polyimide

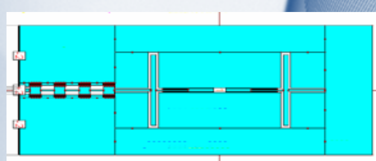
- nanolitho and nano metalization on diference in level surfaces ;



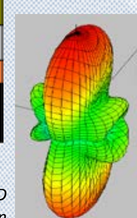


Existing structure; Polyimide bridge 2.5 µm high, Schottky diode area 10 µm²

- **First design for 77GHz direct receiver module and experimental work developed**



Design of the membrane supported structure (Electromagnetic modeling and optimization). At this moment the monolithic integrated Schottky diode was replaced by a comercial flip chip discerete comercial Schottky diode.



Simulated 3D radiation pattern

Investigation of semiconductor oxide materials performance for space environment applications

Project Coordinator: IMT Bucharest; Contact person: Dr. Rodica Plugaru, rodica.plugaru@imt.ro; Web page: www.imt.ro/matspace

PARTNERS: INCDFM EBIC S.A.

November 2013 -December 2015

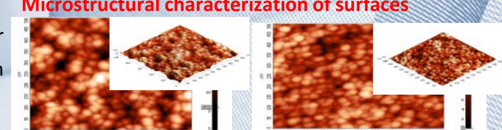
PROJECT GOALS

- To characterize, analyze, and model the radiation response of ZnO semiconductor oxide materials.
- Evaluation of micro-nano structural, electrical and optical functionality domains of semiconductor oxide materials exposed to radiation fields by correlated analysis of the experimental results with atomistic and numerical modeling.

PROJECT Objectives

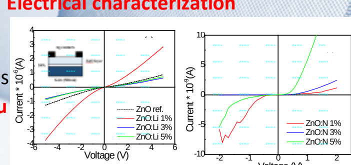
- Synthesis, processing and exposure to radiation field of semiconductor oxides.
- Characterization of semiconductor oxides micro-nanostructure.
- Characterization of semiconductor oxides charge transport and optical properties.
- Numerical and ab-initio simulations of induced space radiation effects on semiconductor oxides

Microstructural characterization of surfaces

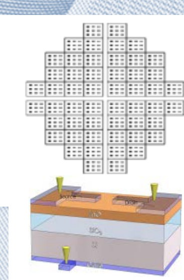


Atomic force microscopy images of ZnO:N thin films surfaces. The films thickness effect on surface roughness.

Electrical characterization

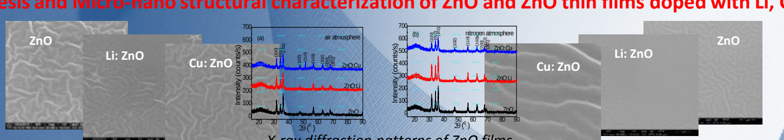


Conductivity of Li:ZnO and N:ZnO films.



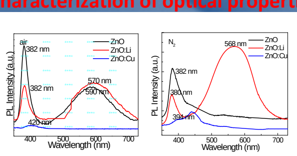
Model of FET demonstrator with ZnO active channel.

Synthesis and Micro-nano structural characterization of ZnO and ZnO thin films doped with Li, Cu

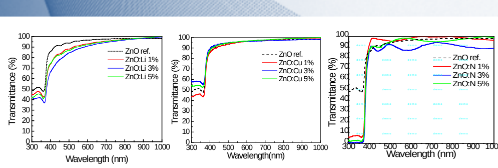


X-ray diffraction patterns of ZnO films

Characterization of optical properties

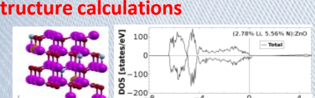


Photoluminescence of ZnO, Li:ZnO,Cu:ZnO films.

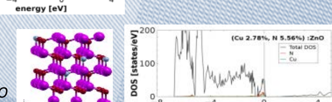


Transmittance in the visible region in presence of doping impurities ZnO, Li:ZnO, Cu:ZnO, N:ZnO films.

Results of First Principles electronic structure calculations



(2.78% Li, 5.56%N):ZnO



5.56% Cu, 11.12%N):ZnO

Acknowledgment: Programme for Research-Development-Innovation on Space Technology and Advanced Research – STAR