L7: Reliability Laboratory

- Mission
- Main areas of expertise
- Research Team
- Specific facilities
- International networks
- National networks

Mission: Providing tools to improve the design&technology of sensors, actuators, micro-systems, nanostructures and microelectronic components by assessing and building the quality & reliability in a Concurrent Engineering approach.

Main areas of expertise: **Reliability building**: Design for reliability and testability - design for manufacture, Reliability monitoring & screening of micro and nanostructures, Burn-in and selection, Reliability of components used in harsh environment (nuclear, geology, automotive, aeronautics, etc.); **Reliability assessing:** Accelerated testing of micro and nanostructures; Failure analysis & physics, Data processing & Reliability prediction, Behaviour of electronic components in harsh environment, Virtual prototyping;

Standardization: Certification, Qualification and periodic tests, Standards and other specifications.

Partner in International Networks: Dr.M.Bazu was member of the Management Board and leader of the cluster "Reliability & Characterisation" of the Network of Excellence ***"Design for Micro and Manufacture PATENT-DfMM"*** (FP6/IST project of NoE, 2004-2008).

The Reliability Laboratory is in the Board of the Service ***Cluster EUMIREL (European Microsystem Reliability)***, aimed to deliver services in the reliability of micro and nanosystems, developed in 2007 by the network ***"Patent-DfMM"*** (other members: IMEC Leuven, Politecnico di Milano, Fraunhofer Institute Duisburg, 4M2C, CSL Liege, BME Budapest, Warsaw Technical University, QinetiQ, Lancaster University, Herriot Watt University, NovaMems, Baolab).

National networks: Contractor of *"Micro-biosensors for pesticide detection in environment and food samples"*, project (2007-2010) in the National Research Programme "PARTNERSHIP";

Contractor of *"Infrastructure development for reliability research in integrated micro-nano systems"*, project (2007-2009) in the National Research Programme "CAPACITIES";

Contractor of *"Development of a laboratory for assessing the quality of the products of micro technologies according to EU requirements - LIMIT"*, project (2006-2008) in the National Research Programme "National research Programme „Excellence in Research – CEEX ;

Member of the "Interdisciplinary network for synthesis and studying semiconductor and conductor nanostructures for obtaining photonic and optoelectronic devices usable in biology and medicine – NANOCRYSTALNET", project (2005-2008) in the National research Programme „Excellence in Research – CEEX", 8 partners (co-ordinated by the University Politehnica Bucharest).

Specific instruments and equipment:

Environmental testing: Reliability Laboratory contains the Laboratory for evaluating the quality of microtechnology products according to EU requirements, provided with modern equipment for:

Environmental testing: Constant mechanical acceleration, Vibration, Storage at temperature, Hermeticity, Mechanical shock;

Testing at combined stresses: Damp heat, Thermal cycling, Pressure + Temperature, Thermal stress + Electrical stress, Electrical stress + Thermal stress + Humidity + Vibrations, Electrical stress + Thermal stress + Pressure, Mechanical ("Tilting") + Thermal stress;

Research Team: The research team is formed by three senior engineers with background in micro-electronics.

From left to right: Marius Bazu, Virgil Emil Ilian, Lucian Galateanu

Laboratory Head — Dr. Marius Bazu (marius.bazu@imt.ro)

He received the B.E. and PhD. degrees from the University "Politehnica" Bucharest, Romania. He was involved in device design and semiconductor physics. Recent research interests: methods for building, assessing & predicting the reliability of MEMS. He developed in Romania the accelerated reliability tests, building-in reliability and concurrent engineering approaches. Leader of one European project (Phare/TTQM) on a building-in reliability technology (1997-1999), Member of the Management Board and workpackage leader and of the NoE "Patent-DfMM", FP6/IST (2004-2008). He is referent of the journals: Sensors, IEEE Transactions on Reliability, IEEE Transactions on Components and Packaging, IEEE Electron Device Letters Microelectronics Reliability and Sensors.

Recipient of the AGIR (General Association of Romanian Engineers) Award for the year 2000. Chairman/lecturer at international conferences: CIMCA 1999 and 2005 (Vienna, Austria), CAS 1991-2008 (Sinaia, Romania), MIEL 2004 (Nis, Serbia & Montenegro). Author of more than 100 scientific papers (IEEE Trans. on Reliability, J. of Electrochem. Soc), Sensors and contributions to conferences (Annual Reliability and Maintainability Symp., Probabilistic Safety Assessment and Management, European Safety and Reliability Conference). Co-author of a book ("Reliability of electronic components") published at Springer Verlag, in 1999.

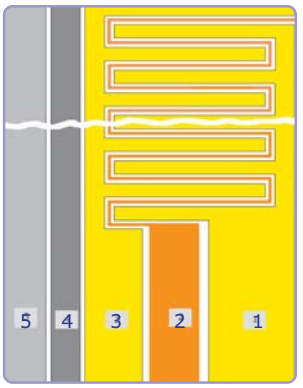
RELIABILITY OF NANOSTRUCTURES

Time degradation phenomena in nanotechnologies (nanostructured materials, nanoelectronic structures and NEMS) were studied.

Achievements: Systems for evaluating the reliability of nanostructured materials, nanoelectronic structures and NEMS were elaborated. The annual project workshop, common with the CEEX project NANOCRYSTALNET (Oct.17, 2008), held at the University Politehnica Bucharest, gathered Romanian specialists in nanotechnologies and four invited specialists, professors at universities from Valencia (Spain) and Gauhati (India).

Project: Technologies at nanometre scale: time degradation phenomena, CNCSIS grant (2006-2008);
Contact person: Marius Bazu (marius.bazu@imt.ro)

BIOSENSOR FOR ENVIRONMENTAL MONITORING



Biosensors for the detection of the environmental pollutant concentrations were developed.

Achievements:
A micro transducer was obtained, based on metallic multilayer deposition by vacuum evaporation on a silicon substrate. Three electrodes were configurated: a counter-electrode made by two metallic layers from Cr and Pt; a reference electrode covered with a layer of Ag/ AgCl; and a working electrode made by two metallic layers of Cr and Au. The possibility to choose tyrozinasis-TYR as biological component for achieving toxin detecting biosensors was investigated.

Layout of the microelectrodes: 1- Working electrode (Source); 2- Working electrode (Gate); 3 – Working electrode (Drain); 4 – Reference electrode; 5 – Counter-electrode.

"PARTNERSHIP" project Micro-biosensors for pesticide detection in environment and food sample, (2007-2010).
Contact person Lucian Galateanu (luciang@imt.ro).

SPECIFIC INSTRUMENTS AND EQUIPMENT

Equipments from CAPACITATI project

- ***Thermal cycling*** *TSE-11-A (Espec Europe), Compact type (air-to-air);*
- ***Combined tests at temperature, humidity, pressure and electrical bias*** *EFS 211M (Espec Europe): Highly Accelerated Stress Test (HAST)*
- ***Combined tests at temperature and electrical bias*** *Three climatic chambers UFB 400 (Memmert), Rack N6711A (Agilent), with modules N6741B, N6743B, N6746B and N6773A, two sources E3648A and E3649.*

Chambers for: -Thermal cycling – TSE-11-A (Espec): High temp. (-65...0°C) and Low temp.(+60…200°C); - Highly accelerated stress test (HAST) - EHS 211M (Espec): Temperature range: +105 ... +142°C, Humidity range: 75%…100% RH, Pressure range: 0.02…0.196 Mpa;
- Damp heat - CH 160 (Angelantoni): Temperature range: -70...+180°C; Speed: 5°C / min, Humidity range: 20…95%RH, between +100 C…+80° C

Chamber for testing at temperature + low pressure - VO400 (MEMMERT): 49 l; +20 .. +200°C; 10 .. 1100 mbar

Electrical characterization: 4200SCS system (Keithley, UK): Voltage CC<100V, Current CC<1A; Impulses: analogical signal 30V, <40MHz; Measurements: Voltage 0,5 μV, Current 1 fA.