

Design for Micro & Nano Manufacture (PATENT) (Packaging, Test and Reliability Engineering in Micro & Nanosystem Technologies) Coordinator – University of Lancaster, UK; Dr. A Richardson (A.Richardson@Lancaster.ac.uk)

PATENT is a reactive initiative that will attempt to realise the vision of providing innovators whether they be members of small companies, universities or multinationals a "predictable" route from M&NT based product concept to product. This will be achieved by realising in the medium to long-term a new concurrent engineering or Design for Micromanufacture Methodology (DfMM) methodology for M&NT-based products that provides designers with the means to design for performance, testability, robustness and dependability competitively, whatever the operating environment. To achieve this vision, major technical challenges need to be solved that are both technically difficult and require workable cross-disciplinary teams. PATENT will address these challenges by:

- Providing experts with the incentive and resources to cooperate in solving key technical challenges in the fields of modelling and simulation, test engineering, reliability engineering and package engineering.
- Encourage cooperation across these fields and application domains to help realise a new DfMM methodology for M&NT based products.

· Realising critical mass of expertise through the formation of a "virtual institute" across Europe that develops, coordinates and delivers training programs for internal staff and the community. It will also disseminate know-how to peers working within related engineering disciplines and promote awareness and interest in the engineering science associated with the manufacture of M&NT based products.

PATENT will initially involve 10 core partners and 14 associate partners with the support of an industrial steering committee consisting of key future users and suppliers of DfMM methodologies and support tools. The team will function around 6 key "Hubs" that are equipment and infrastructure rich that will provide valuable facilities for all partners. These hubs are - Qinetiq, UK, IMEC, Belgium, Fraunhofer IZM, Berlin, IEF, Paris, CRL, Leige and NMRC, Cork.



A. Richardson, PATENT coordinator, at the EuroNet Workshop, Sinaia, oct 2003, Sinaia, Romania

Relevant Topics for PATENT Clusters

- Technology of manufacturing amperometric sensors for the glucose detection - [Manufacturing amperometric sensors; quality certificate](#)
- Technology of manufacturing magnetic field sensors - [Manufacturing magnetic field sensors; quality certificate](#)
- Modeling and characterization of magnetic microstructures - [Development and AFM characterization of magneto-resistive structures](#)
- Development of RF MEMS technologies for passive components integrated in mobile communications systems - [Experimental studies for realization of capacitors on micromachined substrate](#)
- Technology of obtaining nanostructured semiconductors by selective etching of metal-semiconductor eutectics - [Experimental study of metal-semiconductors eutectics and simulation of their mechanical properties, Manufacturing of nanostructured microstructures](#)
- Microelectronics technologies for manufacturing of detectors used for radioactive contamination monitoring in country side - [Manufacturing of the experimental model. Characterization and testing. Demonstration of the workability](#)
- Reconfigurable optical neuron - research, experiment, demonstrations and evaluation of functional parameters - [Realization of demonstrative reconfigurable optical neuron. Experimental evaluation](#)
- Integrated chemical microsensors for environment monitoring - [Manufacturing, experiments. Characterization and testing of micro-sensors and microstructures](#)
- Technology for obtaining FABRY-PEROT micro-interferometers - [Experimental technological processes for micromachining on test structures. Experimental technologies for obtaining FABRY-PEROT micro-interferometers](#)
- Micromachined receiver circuits in the field of millimeter waves - [Modeling, design and characterization of filters and antennas for millimetric waves. Design of receiver modules. Receiving methods in the domain of millimetric waves](#)
- Advanced technologies of module multi-chip integration for Microsystems with radio-frequency applications - [Elaboration of methods for substrates obtaining and design of individual technological processes](#)
- Advanced technique for characterization of the dielectrics used for manufacturing capacitive microtransducers - [Design of test structures; experimental model; characterization](#)
- Microsensors for atomic force microscopy - [Experiments in order to realize thin films cantilevers, Elaboration of microtechnologies for obtaining of pyramidal and conical thin tips for the cantilevers, Realization and characterisation of an experimental model for tip-cantilever assembly](#)

PATENT participants:

1. Coordinator - University of Lancaster, UK

- 2 Universität Bremen, Germany
- 3 IMEC, Leuven, Belgium
- 4 Universite Paris-sud, Orsay
- 5 LIRMM, Montpellier, France
- 6 University College Cork -, National University of Ireland, Cork, Ireland
- 7 QinetiQ Sensors and Electronics, Malvern,
- 8 National Institute for Microtechnologies Bucharest, Romania,
- 9 System Level Integration Limited, Scotland
- 10 4M2C, Berlin
- 11 Fraunhofer Institute for Reliability and Microintegration IZM, Berlin
- 12 Fraunhofer-Gesellschaft e.V.- Dresden

- 13 LAAS - Paul Sabatier University, Toulouse
- 14 Katholieke Universiteit Leuven, Belgium
- 15 Budapest University of Technology & Economics
- 16 THALES, Paris
- 17 Heriot Watt University, Edinburgh, UK,
- 18 Council for the Central Laboratory of the Research Councils, UK,
- 19 Dipartimento di Ingegneria Strutturale. Politecnico di Milano, Italy
- 20 Fraunhofer Institute for Reliability and Microintegration Munich, Germany
- 21 Warsaw University of Technology, Poland
- 22 Centre Spatial de Liege, Belgium
- 23 IXL University Bordeaux 1
- 24 MESA Research Institute, Twente

IMT- Bucharest as a special contact point

IMT-Bucharest has been selected to be a special point of contact to the NAS (or candidate) countries. IMT will have the task to support the Management Board in addressing partners in the NAS, especially in dissemination, training, and networking activities.

In addition there will be a priority to look for adequate organisations in the NAS first, whenever there is a need to include new partners into the project. Some of the PATENT funding, which will be available to external partners for integration activities, will with a high priority be allocated to the NAS. Also, IMT will establish links and launch agreements on information exchange with existing networks, associations and user groups both national, and international. In doing so, IMT will benefit from extensive experience in networking at the national scale, as well as from its participation in other FP 6 projects, including specific support actions (SSA) for candidate countries.

IMT-Bucharest participation in WP 3 (reliability), PATENT

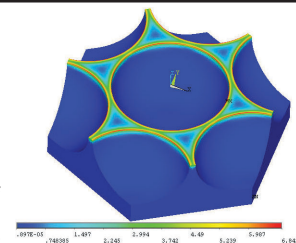
One of the important components of DfMM is reliability engineering. The reliability and characterisation cluster is responsible for design-for-reliability guidelines, identification and analysis of failure and degradation mechanisms and implementation of reliability and materials data extraction methods. This cluster involves a large number of groups from small and large research centres, SMEs and large industry. IMEC, Leuven (Dr. Ingrid de Wolf), IMT Bucharest (Dr. Marius Băzu) and IEF Paris (Dr. Alain Bosseboeuf) will manage the reliability & characterisation team with support of NMRC Cork, Politecnico di Milano, Fraunhofer IZM Munich and Berlin, BUTE Budapest, Heriot Watt Edinburgh, IXL, Bordeaux, QinetiQ, WUT Warshaw, LAAS Toulouse, THALES Paris. IMT will provide the know-how of the specialists from the Reliability Laboratory in failure analysis, degradation mechanisms, design for reliability, accelerated testing, test structures and standardization, but also expertise in MOEMS and NEMS, data-base building and access to special instrumentation such as salt mist, confocal microscopy and holographic interferometry.



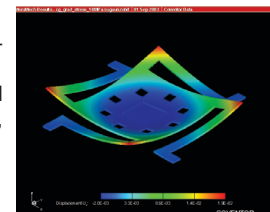
Dr. M. Băzu (IMT-Bucharest), co-chair of PATENT Reliability & Characterisation cluster

IMT-Bucharest expertise in MST design

- ❖ Design and modelling of MOEMS using COVENTORWARE 2003 and OptiFDTD
- ❖ Computer aided design for MEMS devices; Modelling and simulation of MEMS using finite element method (FEM) of MEMS
- ❖ RF MEMS simulation and design with 3iD, Zealand Software
- ❖ Microfluidics modelling- COVENTORWARE 2003
- ❖ Thermal, thermo- mechanical and multi-physics modelling for MEMS, MOEMS



Simulation of a micro matrix for biological applications



Simulation of a movable titanium-gold mirror in a tunable Fabry-Perot filter Displacements under a residual stress gradient of 5MPa/μm - COVENTORWARE 2003 (1000X exaggerated deformation).