



Lowering the barriers to commercialisation for the next generation of micro and nano technology based products

A European 6th Framework Network of Excellence building a new technical community to support European industry in the process of designing manufacturable micro & nano technology based products (Third year Summary of the project)

The concept of extending processes used within the microelectronics industry to fabricate moving parts with feature sizes in the μm scale has stimulated innovation associated with sensing and actuation technology, control of optical signals and the manipulation of extremely small quantities of fluids. Recently, processes have emerged capable of realising these micro components in glass, polymers and metals in addition to silicon. Applications across a wide range of industrial sectors from the bio-medical and pharmaceutical industries to transport have been proposed. State-of-the-art is now at a point where multiple technologies can be integrated into extremely compact systems that utilise materials and structures engineered at the nanometer scale. It is also possible to mix fluidics, optics and electronics on single substrate carriers.

These advances are impressive but successful products are still limited. One of the primary reasons for this is that the feature sizes and complexity of micro & nano technology based systems normally translate into major difficulties in guaranteeing stability, robustness and associated reliability within the target working environment.

The Network of Excellence in Design for Micro & Nano Manufacture “PATENT-DfMM” was built from an increasing degree of synergy in the experience of both academics and industrialists working on test and reliability issues, modelling technology and the integration, packaging and assembly processes. It became clear that if the design cycle and associated tools could be enhanced to allow designers to explore reliability and testability issues early in the design process and predict the impact of package, assembly and the external environment on the micro and nano scale structures, design iterations and manufacturing costs could be reduced. Furthermore, the ability to model interactions between the micro and nano world and the product environment together with an understanding of the ageing, degradation and failure modes within the devices and materials would allow reliability to be better predicted and improved.

21 research laboratories and 3 companies constitute this Network of Excellence that is coordinated by Lancaster University, UK. The consortium includes the national research centres IMEC Leuven/Belgium, Tyndall Cork/Ireland, CNRS Toulouse/France, IMT Bucharest/Romania and CCLRC UK, the industrial research centres Fraunhofer IZM (Berlin and Munich) and IMS Duisburg and university research laboratories, Heriot Watt University, University of Montpellier (LIRMM), Polytecnico of Milan, Budapest University of Technology, CSL University of Liege, IXL Bordeaux, University of Bremen, Katholic University of Leuven, CEA-Leti Grenoble, University of Oulu, MESA+ Twente, and Warsaw University of Technology. The industrial partners include an end user, QinetiQ UK, training provider, ISLI UK and a marketing and business strategy company, 4M2C Germany.

The project is monitored and supported by an Industrial Advisory Board that has been revised in 2006. 20 companies are involved that includes EDA providers (Coventor, Dolphin Integration and SoftMEMS), equipment manufacturers (SUSS MicroTec, National Physical Laboratory and MicRed), and both fabrication facilities and system integrators (ST Microelectronics, Renishaw, BAE Systems, Colibrys, Infineon Sensor, IMEGO, Protron Mikrotechnik, C2V, MicroCircuit Engineering, Alcatel Space, Philips, NXP, and BCF Designs). The IAB also benefits from the input of the consultancy company EnablingM3. A steering group has also been established to assist with the launch of the Service Clusters and business planning consisting of ST Microelectronics, C2V, EnablingM3, Micro Circuit Engineering, Proton Mikrotechnik, IMEGO, BCF Designs, NXP, Alcatel Space and Renishaw.

As of January 2007, over 70 activities have been launched under the project framework to improve integration, generate new collaborative intellectual property through joint research, secure commercialisation routes for key services and establish the team as a key international cluster. Activities in the first 12 months mainly targeted improved integration within the 4 Virtual Laboratories (Design for Test, Modelling & Simulation, Reliability and Package Engineering), the second 12 months has seen more activities across these virtual laboratories and within the third period major achievements have been the launch of three flagship projects, and approval for the creation of clusters of R&D providers (industry and academia) with valuable synergies willing to deliver these capabilities through commercial services. The first industrial contract to these “Service Clusters” has been awarded to the μ HUMS activity.

Key output in 2006 includes a 6 institute service cluster in embedded test based on work and associated IPR in motionless testing of moving structures such as inertial sensors, electrical only test strategies and embedded test strategies for fluidics and BioMEMS systems. New techniques have been developed based on bias modulation and a proof of concept demonstrated. A service cluster in the area of Micro-Electro-Fluidics (MEF) has been launched from the flagship project BioDROP based on a collaborative team and technical capability jointly published. Work is now targeting drug discovery and peptide synthesis platforms. In this area work is now merging with modelling activities that over the past 18 months has been focusing on fault and fault free modelling of droplet transport technology. The Reliability Flagship projects RELMETH (Reliability Methodologies, VIBSHOCKT (Vibration and Shock in Harsh Environments and HERMETICITY (Hermeticity sensing) have taken a major part in two new Service Clusters μ HUMS and EURIMEL (European Microsystems Reliability Service Cluster). The μ HUMS cluster has developed from the HUMMS flagship project.

Plans for 2007

Within the first two years of the project, multi-disciplinary distributed teams have been established who are willing to deliver services to industry in collaboration. Critical mass in each of the 4 key disciplines (Design for Test, Modelling & Simulation, Reliability and Package Engineering) has been established with numerous activities crossing the conventional discipline boundaries. An initial portfolio of services, skills and IPR has been compiled. In 2006 €613k of resource funded three flagship projects that include:

1. Design for Manufacture of Integrated Bio-MEMS platforms,
2. Reliability of Integrated MEMS that embraces clusters in acceleration factors, package reliability and harsh environments and
3. MEMS for Health and Usage Monitoring Applications).

Phase 1 of these projects was completed Nov 2006 with good results. The concept of Service Clusters to achieve self sustainability has been explored, developed and approved by all partners. (Final ratification of the service cluster concept was confirmed at the annual assembly meeting Jan 2007).

In 2007 the majority of resource will be focused on self sustainability. This means that 41% of funding will be dedicated to supporting the service clusters and completing the flagship projects. The technical workpackages and training will merge into one new workpackage “Integration of Research”. This new workpackage will be managed by a steering committee. An internal Call 7 has been launched in March 2007 to invite partners to submit proposals to integration activities for funding. The call will remain open until all the available funding for 2007 is allocated. The Service Clusters concepts for development in 2007 are:

- Microelectronic Fluidic System Service Cluster (demonstrator BioDROP flagship)
- Embedded Test Service Cluster
- MicroHUMS Service Cluster (HUMMS Flagship demonstrator)
- EUMIREL Reliability Service Cluster (Demonstrator Reliability flagships)
- Wafer Level Bonding
- Design Cluster

More information:

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