

Dear Reader,



The Network of Excellence (NoE) Patent-DfMM aims to establish a collaborative team to provide European industry with support in the field of "Design for Micro & Nano Manufacture (DfMM)" to

ensure that problems affecting the manufacturing and reliability of products based on micro & nano technologies (MNT) can be addressed before prototyping and production. For more information: <http://www.patent-dfmm.org/>

Welcome to the new edition of our bi-monthly E-Newsletter, which will keep you updated on project related activities, but also on other DfMM activities that run outside of the project.

We apologise in case you have been added to our database in error: if so, please reply by e-mail with "UNSUBSCRIBE" in the subject field.

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We welcome your comments and contributions.

Happy reading!

Patric Salomon  
NoE Patent-DfMM News Editor

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## **News from the NoE Patent-DfMM**

### **NEXUS Methodology Working Group "Reliability & Test" in co-operation with NoE PATENT-DfMM: Brainstorming/factfinding meeting on 6 Dec 2005, Paris**

The NEXUS Reliability & Test Methodology Working Group will be re-launched through PATENT-DfMM. Prior to a kick-off meeting (planned for Q1/2006) a brainstorming/factfinding workshop is planned in conjunction with the NEXUS meeting of EC-funded IP/NoE projects in Paris, 5-6 Dec 2005. The objectives of this meeting will be to gather recommendations and interest from the NEXUS members and EC-funded IP/NoE projects on how this MWG should run over the next years. Main objectives proposed for the MWG:

- Create a venue where industry can share knowledge in reliability and test problems
- Create a venue where industry can discuss future trends and priorities
- Create an environment where industry can interact with the PATENT-DfMM database developments through requests for content and contributions to the content
- Provide an environment where industry can network and understand the reliability and test requirements of PATENT-DfMM services in particular
- Provide a central contact point for international links in the area of MNT reliability and test (MIG, MANCEF, SEMI, etc.)
- Provide a central point for the development and co-ordination of major new European initiatives in MEMS reliability and test  
And possibly:
  - Drive a roadmapping activity
  - Contribute to standardisation activities
  - Provide a central point for accessing training in reliability and test

Contact: Prof Andrew Richardson, Lancaster University, UK, E-mail: [A.Richardson@Lancaster.ac.uk](mailto:A.Richardson@Lancaster.ac.uk), [www.patent-dfmm.org](http://www.patent-dfmm.org)

### **DfMM Training Course "Modelling & Analysis of MEMS Packages", 12-14 Dec 2005, IEF, Paris, France**

This latest PATENT-DfMM course will introduce to current packaging techniques and in the next track focus on experimental and simulation techniques. The presenters (Olaf Wittler, Fraunhofer IZM, Berlin; Alain Bosseboeuf, IEF, Paris; Ingrid De Wolf, IMEC, Leuven; Andrew Richardson, ULAN, Lancaster; Changhai Wang, HWU, Edinburgh) will cover the following:

- Introduction to MEMS Packaging Techniques and Technology:  
Examples of MEMS applications for different markets, Difference between Electronics and MEMS packaging strategies and requirements, Assembly/Interconnection and Encapsulation, Examples of MEMS packaging

- Analysis Techniques for MEMS Packages:  
Optical techniques for films/MEMS inspection and mechanical testing before packaging, Testing techniques for wafer bonding and wafer level packaging, Practical training: MEMS characterization by optical profilometry-vibrometry, Hermeticity, Mechanical strength, Failure analysis techniques, Reliability testing, Testing approaches for submicron and nanomechanical material behaviour – A brief overview, Deformation measurements at micro and nano scale by digital image correlation techniques (includes practical training), Residual stress measurements
- MEMS Package Simulation Techniques:  
Basic mechanics, Material behaviour and characterisation, Failure mechanisms and life time models (Failure Mechanics, Fracture Mechanics), Basic package MEMS interaction, Practical Training

More information: [http://www.patent-dfmm.org/site/events/training\\_courses2005.pdf](http://www.patent-dfmm.org/site/events/training_courses2005.pdf)

Contact: George Bell, ISLI, UK, E-mail: [george.bell@sl-i-institute.ac.uk](mailto:george.bell@sl-i-institute.ac.uk)

### **DfMM Training Course “Thermal Issues in MEMS”, 11-12 Jan 2006, Berlin, Germany**

To continue our series of training courses, we are happy to announce that we are planning to hold another training session with the topic “Thermal Issues in MEMS” at the Fraunhofer IZM in Berlin, Germany in January 2006. More details will be available on our website.

Contact: George Bell, ISLI, UK, E-mail: [george.bell@sl-i-institute.ac.uk](mailto:george.bell@sl-i-institute.ac.uk)

### **NoE PATENT-DfMM “MEMS Packaging Roadmap” Project**

The Network of Excellence “Design for Micro & Nano Manufacture (PATENT-DfMM)” is planning to set up a roadmap on MEMS packaging. Two initial workshops will be held in Q1/2006 to assess industry needs and discuss which research work the project should target for the next two years.

1st workshop: HWU Edinburgh, Scotland: planned for end Jan 2006

2nd workshop: FhG-IZM Berlin, Germany: planned for Feb/Mar 2006

Both workshops are open to the public and especially industry participants are encouraged to join the discussion.

More information will be available on the PATENT-DfMM website [www.patent-dfmm.org](http://www.patent-dfmm.org)

Contact: Fabien Holler, HWU, Scotland, UK, E-mail: [f.holler@hw.ac.uk](mailto:f.holler@hw.ac.uk)

### **Further DfMM R&D Projects funded**

Being an FP6 Network of Excellence, PATENT-DfMM has a very flexible approach to distribute budgets within the project. In an annual (internal) review, which is supported by the Industry Advisory Board (IAB), priorities for the next period will be set. Internal calls for project proposals will then be launched throughout the year. The following internal projects have been recently approved for funding as part of the PATENT-DfMM research and integration activities:

#### **Continuation of Biosensors/BioMems fluidics project (WP 1)**

Develop test strategies for bio-mems platforms to detect key failure and degradation modes.

Objective: New built in strategies for Bio-MEMS.

Contact: Hongsheng Lui, University of Lancaster; Pascal Nouet, E-mail: [Pascal.Nouet@lirmm.fr](mailto:Pascal.Nouet@lirmm.fr)

#### **Motionless accelerometer testing (WP 1)**

Production testing of low cost accelerometers using electrical only stimuli.

Objective: The first phase of the project consists in reviewing available techniques and in making proposals for electrical only test solutions for all kinds of accelerometers.

Contact: Zhou Xu, E-mail: [zhou.xu.99@gmail.com](mailto:zhou.xu.99@gmail.com); Pascal Nouet, E-mail: [Pascal.Nouet@lirmm.fr](mailto:Pascal.Nouet@lirmm.fr)

#### **Round Robin modeling study (WP 2, 4)**

Objective: To investigate and model the key trade-offs relevant to die attach adhesives for packaging/ CoB assembly of stress sensitive MEMS devices. Specifically the trade-off between CTE, stiffness

(modulus) and thickness, on package induced thermomechanical stress. Physical measurements will be taken using stress sensitive devices and test structures. The various device, adhesive and package/ substrate assemblies will be modelled. The project seeks to develop benchmarked and validated models for MEMS packaging, including poorly matched assemblies.

Contact: Alan Brown, E-mail: [agbrown@taz.QinetiQ.com](mailto:agbrown@taz.QinetiQ.com); Orla Slattery, E-mail: [orla.slattery@nmrc.ie](mailto:orla.slattery@nmrc.ie)

### **Micro and Nano Technology - Engineering, Business and Society (MNT-EBS) Course Development (WP 5)**

Objective: To develop a cross-disciplinary course in MNT (DfMM, Business and Ethics). The course would cover: MNT Business, Marketing and Finance; Social, Ethical and Regulatory dimensions of MNT; Technical challenges, barriers and opportunities. It would target senior engineers, management and exec level industrial participants.

Contact: Denis Koltsov, E-mail: [denis@koltsov.com](mailto:denis@koltsov.com); George Bell, E-mail: [George.Bell@sl-institute.ac.uk](mailto:George.Bell@sl-institute.ac.uk)

### **Development of a MEMS testing tutorial (WP 5)**

Pull together MNT test material from 3 partners and turn it into a tutorial.

Contact: Pascal Nouet, E-mail: [Pascal.Nouet@lirmm.fr](mailto:Pascal.Nouet@lirmm.fr)

### **Proposal in support of an SME working in the field of Compound Semiconductor Technologies within the design and testing of a MOEMS (WP 7)**

Objective: To design, manufacture and test a fully integrated and packaged optical microengineered encoder. The project forms a service to an external SME.

Contact: Marc Desmulliez, E-mail: [M.Desmulliez@hw.ac.uk](mailto:M.Desmulliez@hw.ac.uk)

### **Technology roadmap for MEMS Package Engineering (WP 4, 7)**

Objective: Two dedicated workshops will be held at Heriot Watt University Edinburgh and Fraunhofer IZM Berlin to identify and understand present and future industry requirements. The information gathered will be used to determine how the Package Engineering should best target its efforts in terms of both technical focus and timescales. The workshops are open to interested participants external to the project.

Contact: Fabien Holler, E-mail: [f.holler@hw.ac.uk](mailto:f.holler@hw.ac.uk)

### **Database Activities (WP 4)**

Objective: To establish on-line databases for Test structures for microsystems and microsystems packaging, Packaging capabilities, and Packaging solutions. In addition the WP3 databases on Materials and Failure Modes will be modified to allow packaging materials and package related failure modes to be included. The new databases will be constructed taking account of future integration/ inter-linking with WP3 databases on materials, instrumentation and failure modes.

Contact: Alan Brown, E-mail: [agbrown@taz.QinetiQ.com](mailto:agbrown@taz.QinetiQ.com)

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## **Abstract deadlines for conferences**

### **Call for Papers, Extended Submission Deadline: 15 Nov 05**

### **DTIP 2006 Symposium on Design, Test, Integration and Packaging of MEMS/MOEMS and Workshop on Design for Reliability and Manufacturability**

This Symposium will be a follow-up to the very successful issues held in 1999 and 2000 in Paris and in 2001, 2002 and 2003 in Mandelieu-La Napoule, and in 2004 and 2005 in Montreux, Switzerland. This series of Symposia is a unique single-meeting event expressly planned to bring together participants interested in manufacturing microstructures and participants interested in design tools to facilitate the conception of these microstructures. Again, a special emphasis will be put on the very crucial needs of MEMS/MOEMS in terms of packaging solutions. The goal of the Symposium is to provide a forum for in-depth investigations and interdisciplinary discussions involving design, modeling, testing, micromachining, microfabrication, integration and packaging of structures, devices, and systems.

More information about the conference and submission guidelines: <http://tima.imag.fr/conferences/dtip/>

Contact: Bernard Courtois, TIMA Labs, France, E-mail: [Bernard.Courtois@imag.fr](mailto:Bernard.Courtois@imag.fr)

**Call for Papers, Submission Deadline: 15 Nov 05**  
**EuroSimE 2006 Thermal, mechanical and multi-physics simulation and experiments in micro-electronics and micro-systems**

After six successful editions of the EuroSimE conference, a seventh edition, EuroSimE2006, will be held in Milano from 23-26 Apr 2006. EuroSimE 2006 will address the results of both fundamental research and industrial application for thermal, mechanical and multiphysics solutions of (micro)-electronics and Microsystems, focusing on advanced simulation and experiments. The conference will include keynote presentations and sessions with a wide range of topics, in addition short courses will be offered for professional training. For more details and your abstract submission, please visit: [www.eurosime.org](http://www.eurosime.org)

Contact: Alberto Corigliano, Politecnico di Milano, Italy, E-mail: [alberto.corigliano@polimi.it](mailto:alberto.corigliano@polimi.it)

**2nd Call for Paper/ Submission Deadline: 15 Nov 05**  
**International MEMS Conference 2006, Singapore**

The iMEMS2006 will be held in Singapore, from 9-12 May 2006. It aims to provide an opportunity for academicians, professionals & Industrialists in various related fields from all over the world to come together and learn from each other. An additional goal of the conference is to provide a place for academicians, professionals, industrialists with cross-disciplinary interests related to MEMS to meet and interact with members inside and outside their own particular disciplines. You can now submit an extended 2-page Abstract on - Aim, Motivation, Results & Discussions - until 15 Nov 05, for topics and more conference details please visit: <http://nanomicro.org/imems06/>

Contact: Francis E.H. Tay, Singapore, E-mail: [ftay@alum.mit.edu](mailto:ftay@alum.mit.edu)

**EuroSimE 2006**  
23 - 26 April 2006  
Milano, Italy  
Abstract Deadline: **15 November 2005**  
[www.eurosime.org](http://www.eurosime.org)

**DTIP 2006 - SYMPOSIUM on Design, Test, Integration and Packaging of MEMS/MOEMS**  
26 - 28 April 2006  
Stresa, Lago Maggiore, Italy  
Abstract Deadline: **15 November 2005**  
<http://tima.imag.fr/conferences/dtip/>

**NSTI Nanotech 2006 Conference and Trade Show**  
7 - 11 May 2006  
Boston, MA, USA  
Abstract Deadline: **18 November 2005**  
<http://www.nsti.org/Nanotech2006/>

**ACTUATOR 2006 International Conference on New Actuators**  
14 - 16 June 2006  
Bremen, Germany  
Abstract Deadline: **30 November 2005**  
[www.actuator.de](http://www.actuator.de)

**Workshop on "Wafer Bonding for MEMS Technologies"**  
9 - 11 April 2006  
Halle, Germany  
Abstract Deadline: **9 January 2006**  
[www.microtesting.de](http://www.microtesting.de)

**4M2006 - International Conference on Multi-Material Micro Manufacture**

20 - 22 September 2006

Grenoble, France

Abstract Deadline: **28 February 2006**

[www.4m-net.org](http://www.4m-net.org)

**List of Events**

3 - 5 November 2005

**ISNM 2005 International Symposium on Nanomanufacturing**

Limassol, Cyprus

[www.isnm2005.org](http://www.isnm2005.org)

15 - 17 November 2005

**Nanotech-Montreux 2005**

**European Conference on Micro & Nanoscale Technologies for the Biosciences**

Montreux, Switzerland

[www.nanotech-montreux.com](http://www.nanotech-montreux.com)

15 - 18 November 2005

**Productronica 2005**

Munich, Germany

[www.global-electronics.net/id/24198](http://www.global-electronics.net/id/24198)

25 - 26 November 2005

**4M Workshop Micro/Nano Engineering "Technology and Applications"**

Sofia, Bulgaria

[www.4m-net.org](http://www.4m-net.org)

12 - 14 December 2005

**PATENT-DfMM Training Course "Modelling & Analysis of MEMS Packages"**

Paris, France

[www.patent-dfmm.org](http://www.patent-dfmm.org)

12 - 14 December 2005

**MNT 2005 International Conference on Nanomaterials and Nanomanufacturing**

London, UK

<http://www.iom3.org/events/mnt2005.htm>

11 - 12 January 2006

**PATENT-DfMM Training Course "Thermal Issues in MEMS"**

Berlin, Germany

[www.patent-dfmm.org](http://www.patent-dfmm.org)

21 - 26 January 2006

**MOEMS-MEMS 2006 Micro & Nanofabrication**

San Jose, CA, USA

<http://spie.org/conferences/calls/06/pw/>

22 - 26 January 2006

**MEMS 2006 International Conference on Micro Electro Mechanical Systems**

Istanbul, Turkey

[www.mems2006.org](http://www.mems2006.org)

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## Other DfMM-related News

### **NEXUS Market Analysis for MEMS and Microsystems III, 2005-2009 - NEW!**

In the next five years, the market will grow at 11% per year from \$33 billion to \$57 billion in 2009, according to the new market study by NEXUS: NEXUS Market Analysis for MEMS and Microsystems III, 2005-2009. This update now includes a break-out of the market for 1st level packaged MEMS and MST. Using this definition, the market is expected to double from \$11.5 billion in 2004 to \$24 billion in 2009 - a CAGR of 16%. The report is available at 1100 Euro from the NEXUS Office and through distributors such as WTC, SGT, ATIP and 4M2C/enablingMNT. Order forms and information: [www.enablingmnt.com](http://www.enablingmnt.com)

Contact: Patric Salomon, 4M2C, Berlin, E-mail: [info@4m2c.com](mailto:info@4m2c.com)

### **Job Vacancies at ISLI, Livingston, Scotland, UK: Senior MEMS Design Engineer and MEMS Design Engineer**

The Institute is seeking to recruit two MEMS design engineers. Candidates will be working as part of a flagship collaborative research project between the Institute and several universities. As part of the ISLI team, you will apply your MEMS design skills to the field of highly integrated MEMS systems; integrating Si MEMS, micro-fluidics, photonics and electronics. The project will be highly multi-disciplinary with applications expected in biology, medicine, metrology, chemical synthesis and smart structures. As the project develops, you will generate new ideas and build these into further collaborative projects in their own right. The successful candidates will have a 1st or upper 2nd degree plus a PhD in a relevant field, or equivalent. You will be familiar with silicon MEMS and its applications, having experience of the design process, techniques and tools. Experience in micro-fluidics, optics, and electronics are advantageous.

Contact: Mark Begbie, ISLI, Livingston, Scotland, UK; E-mail: [mems@sl-i-institute.ac.uk](mailto:mems@sl-i-institute.ac.uk)

### **Post-doc/ Ph.D. Scholarship at The Angstrom Laboratory, Uppsala, Sweden, on 3-D-Integrated Micro/Nano Modules**

The Scholarship is intended for a new collaborative EU funded Integrated Project on miniaturized 3-D-Integrated Micro/Nano Antenna Modules to be coupled to a RF front-end unit, used in the future wireless sensor networks. We are looking for a Post-doc with experience or interest in Microwave technology as well as Polymer based MEMS and associated processing technologies. The goal is to combine advanced polymer technology with solid-state technology creating functional self contained micro/nano antenna-to-front-end modules operating at microwave frequencies. This position is open for Post-doc's as well as for advanced PhD students aiming for an academic exchange. Applications before 15 Dec 2005!

Contact: Anders Rydberg, Uppsala University, Sweden; E-mail: [anders.rydberg@signal.uu.se](mailto:anders.rydberg@signal.uu.se)

### **Coventor & MEMS Exchange: MEMS Tools Initiative Partnership**

Coventor Inc. and MEMS Exchange have announced the formation of a strategic alliance to help researchers and companies identify and develop MEMS and nano-technology based products. This partnership improves the interaction of the MEMS Exchange design with the foundry services organization. MEMS Exchange now has access to Coventor's suite of MEMS software products, which can simplify the design, communication and content exchange for all of its customers. Coventor will issue trial licenses of its MEMulator™, Etch3D™ and DESIGNER™ software tools to qualified MEMS

Exchange customers upon request. MEMS Exchange customers who do not currently have access to Coventor tools are invited to request a free trial period.

Contact: Eric Ehlers, Coventor Inc., USA, E-mail: [eric.ehlers@coventor.com](mailto:eric.ehlers@coventor.com)

### **SUSS Introduces New LED Wafer-Level Bonding Technology**

SUSS MicroTec AG introduces their new patent pending technology that performs simultaneous bonding of wafers, including eutectic processes to achieve impressive cost reduction while increasing throughput up to 8X. SUSS new high throughput LED bonder has been accepted worldwide for applications including bonding of HIGH POWER and HIGH BRIGHTNESS LEDs. The SUSS LED bonder has been proven in production to be a cost reducing, yield improving, equipment set. Additionally this is the ideal equipment solution for the simultaneous temporary bonding of wafers to a carrier for subsequent WAFER THINNING. High brightness LEDs are capable of matching conventional lighting, are smaller and longer lasting, are low in power consumption, and have a low thermal output. All of which helps our environment. With its superior temperature and uniformity, precision bond tooling, and newly designed high alignment chamber, the SB8eLED bonder will surely be utilized in the production of other innovative products.

Contact: Fiona Kemp, SUS MicroTec AG, Germany, E-mail: [f.kemp@suss.de](mailto:f.kemp@suss.de)

### **RF MEMS activities in THALES**

RF MEMS activities in the THALES Group are jointly led by THALES Airborne Systems for the applications and concepts, and THALES Research & Technology for the design and technology operations. Undergoing works cover: tunable inductors, high power tunable capacitors, SPNT switches, MEMS microwave filters, microwave Si-based micro-vacuum tubes, and special MEMS functions.

Contacts: Pierre NICOLE (TAS), E-mail: [pierre.nicole@fr.thalesgroup.com](mailto:pierre.nicole@fr.thalesgroup.com), Afshin ZIAEI (TRT), E-mail: [afshin.ziaei@thalesgroup.com](mailto:afshin.ziaei@thalesgroup.com)

### **PATENT-DfMM Industry Advisory Member C2V selected for Dutch "Gallery of Fame"**

Senter Novem, an agency of the Dutch Ministry of Economic Affairs, has selected C2V as the first company in the "Gallery of Fame". Being listed in the Gallery of Fame is a token of appreciation for the outstanding work executed by the identified company and for the acknowledgement that the investments resulted in benefits for the company and Dutch society as a whole. The award recognizes the combination of excellence in high-tech innovation and economical ambitions. In particular the microDELTA micro-fluidics integration technology, now applied in an ultra fast handheld micro Gas Chromatograph, contributed to this success. The handheld microGC has applications in security and safety, industrial processing, laboratories, and quality control.

Contact: [info@c2v.nl](mailto:info@c2v.nl), <http://www.c2v.nl>

### **Review: "Dynamic electro-thermal simulation of Microsystems", Journal of Micromechanics and Microengineering 2005, v. 15, N 11, p. R17-R31**

An overview of electro-thermal modeling of microsystems is presented. We consider the most important coupling between thermal and electrical phenomena, and then focus Joule heating. The review contains: a description of different solution approaches for the heat transfer partial differential equation; analytical solutions and numerical approaches based on spatial discretization of the thermal domain; the description of the dynamic compact thermal modelling. We emphasize the formal model order reduction methods, because they directly follow the spatial discretization, and thus preserve the

investment into the finite element modelling.

More information: <http://stacks.iop.org/0960-1317/15/R17> (free access until mid November)

Contact: Evgenii Rudnyi, University of Freiburg, Germany, Email: [rudnyi@imtek.uni-freiburg.de](mailto:rudnyi@imtek.uni-freiburg.de)

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Next issue: **10 Januar 2006** (deadline for contributions: **3 January 2006**)

Please feel free to send us any DfMM-related news that might be of interest for our readership.

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This e-mail newsletter contains public information, only. Please feel free to distribute it to anyone who might be interested in the topics.

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