MME 2016

Cork, Ireland 28-30th August 2016

Technical Programme

www.micromechanicseurope.com

Programme Summary

Sunday 28th August

18:00-20:00 Welcome, Registration & Poster Hanging

21:00 Traditional Irish music at 'An Spailpín Fánach'

Monday 29th August

08:30 Registration

09:00 Opening Address & Welcome

09.15 **Invited - Prof. Massimo De Vittorio (IIT, Italy)**

10:00 Flash Session A

11:00 Poster Session A & Coffee

12:30 *Lunch*

13.30 **Invited – Prof. Per Ohlckers (HBV, Norway)**

14.15 Flash Session B

15:00 Poster Session B & Coffee

16:00 Paper Review Session (The Sextant Pub, *www.thesextant.ie*)

17.45 *Close of Day 1*

18:15 Bus Transfer to Old Midleton Distillery

18.45 Distillery Tour & Whiskey Tasting, Gala Dinner & Entertainment

23:00 Return to Cork

Tuesday 30th August

09.00 **Invited - Prof. Martin Richter (Fraunhofer EMFT, Germany)**

09:45 Flash Session C

11:00 Poster Session C & Coffee

12:30 *Lunch*

13.30 **Invited– Mr. Ray Goggin (Analog Devices, Ireland)**

14.15 Flash Session D

15:15 Poster Session D & Coffee

16:30 Closing Remarks, Poster Awards and MME 2017

17.00 *Close of Day 1*

19:00 Informal Social Event

Technical Programme

Invited Speakers

We are delighted to welcome the following Invited Speakers to Cork for the 27th Micromechanics and Microsystems Europe Workshop, and we sincerely thank them for taking the time to share their insights into emerging trends and technologies in European microsystems.

Soft Piezoelectric MEMS Technologies for Sensing and Energy Harvesting

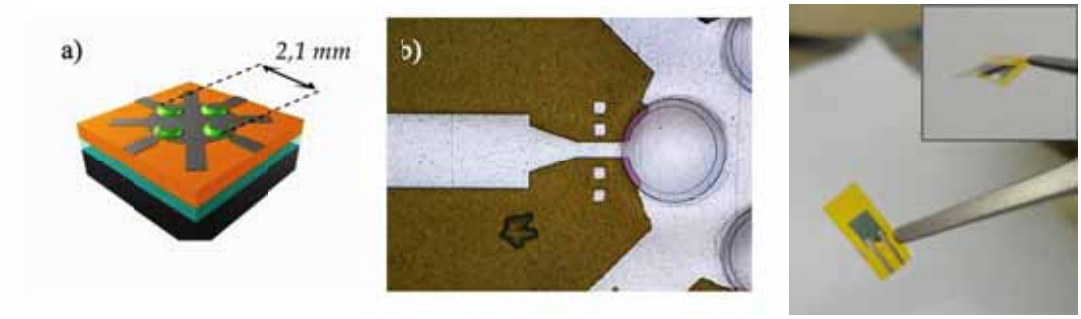
Massimo De Vittorio

Istituto Italiano di Tecnologia (IIT), Center for Bio-Molecular Nanotechnology, Università del Salento, Lecce, Italy

Abstract. Next generation remote sensors, wearable and implantable electronics applied to the internet of things (IoT) and of medical things (IoMT) requires advanced material and device properties including ultrahigh sensitivity, low power consumption, biocompatibility. Sensing and power management need to be embedded in a single flexible substrate to be integrated in textiles, on skin or even implanted in the human body.

Soft piezoelectric technology can be a perfect match to these challenging goals. In this presentation it will be shown that thin film piezoelectrics on flexible polymers can be synthesized and processed to produce compact, high-sensitive arrays of pressure sensors, mimicking the functions of human skin, and can also be at the same time exploited to harvest mechanical energy. By virtue of their intrinsic softness and flexibility this technology can scavenge energy non-resonantly at very low frequencies, opening interesting opportunities for retrieving energy from motion, heartbeat, blood pressure or breath.

It will be also shown that small piezoelectric flags can efficiently act as harvesters of energy at extremely low wind or water flow speed in outdoor environments, with a cut-in flow speed of 0.1 m s^{-1}., more than one order of magnitude lower than wind turbines, and with a generated power of the order of mWs cm^{-3} at higher wind speed.



Left:1 – a) Scheme and image of a tactile sensor array based on aluminum nitride on polyimide substrate for artificial skin applications. Right – Piezoelectric flags for energy harvesting.

Biography. Massimo De Vittorio is director of the Center for Biomolecular Nanotechnologies (CBN) of the Istituto Italiano di Tecnologia (IIT), associate professor at Università del Salento and co- founder of the national nanotechnology laboratory (NNL) of the Istituto Nanoscienze CNR. His research activity deals with the development of science and technology applied to nanophotonics, nanoelectronics and nano and micro electromechanical systems (NEMS/MEMS). Author of about 200 papers, 60 proceedings of international conferences, 13 patents and several invited/keynote talks to international conferences, he is also senior editor of the Journal IEEE Transactions on Nanotechnology and founder of several start-up companies, spin-off of his research activities.

“Publish or Perish”: A Guide for Writing Scientific Papers in Natural Sciences- with Some Subjective Recommendations

Per Ohlckers

Department of Micro- and Nano Systems Technology, University College of Southeast Norway (HSN), Horten, Norway

Abstract. Scientific writing is important in all sciences used to document research results. This presentation discusses scientific writing in natural science, where a major cornerstone is that all progresses of knowledge are made by proving hypotheses or establish facts by experiments or theoretical calculations or both. The quality of the content of the scientific writing is that your documented research work can be repeated as completely as needed for validation by any peers by following your descriptions of the work performed. This is an important inherent quality assurance scheme of natural science to assure that the achieved results are correct and can be used as an input to further expand the research frontiers. In addition, such peer reviews is used to evaluate the research originality compared to other published research work. Scientific writing is about documenting the research performed in this way. The contents of the different typical chapters of a scientific paper in natural sciences are outlined here with general guidelines and subjective recommendations. A suitable format is given as a template with guidelines for the structure and look: “The Gold Standard” (or IMRAD –Introduction, Methods And Discussions) The presentation is using a an electronic file template from Institute of electrical and Electronics Engineers (IEEE) as an example. It is a well-structured template, which is widely used also outside IEEE, including the Micromechanics and Microsystems Europe workshops. At the end, in a more unceremonious form, some practical advices for writing successful papers are presented and commented. In conclusion, subjective recommendations for scientific writing is given - use it or not.

Biography. Per Ohlckers is Professor at Department of Micro- and Nano Systems Technology at University College of Southeast Norway (HSN), Horten, Norway from September 2005. He is also Professor Emeritus at Department of Physics, University of Oslo. He received his M.Sc. degree in Physical Electronics from Norwegian Institute of Technology (NTH, now NTNU) in 1974.
Per Ohlckers has contributed to the development of several successful commercial products and he more than 150 international scientific publications with focus on silicon sensor technology and micro- & nanotechnologies, including two patents. He is lecturing in semiconductor devices at HSN, and earlier he lectured in Packaging & Interconnection Technology for Electronic Systems at HSN and at University of Oslo using a textbook he has co-authored, which were used at several other universities around the world.
His employment history includes positions as General Manager of the start-up microsystem company Diamond Nanomachines as, earlier Fifty-four point Seven (54.7) from 1999, Vice President, Research & Product Development at DAVIS A/S. Drammen, Norway from 1998 to 1999, R&D Coordinator at SensoNor, Horten, Norway from 1995 to 1998, and 15 years at SINTEF Instrumentation in different positions: Deputy Director, Research Manager, Microelectronics Section and Manager of Liaison Services Section. He had a 6 months stay as a visiting scientist at Electronics Design Center, Case Western Reserve University, Ohio in 1983-84. After graduation, he had a 5 years employment at Aksjeselskapet Mikro Elektronikk (ame), Horten, Norway. He was a member of the Steering Committee for the International Conference on Solid State Sensors and Actuators from 1997 to 2007, and a member of the organisation committee for this conference in Stockholm in 1995. He was Chairman of the Micromechanics and Microsystems Europe workshops in 1998 and in 2011.

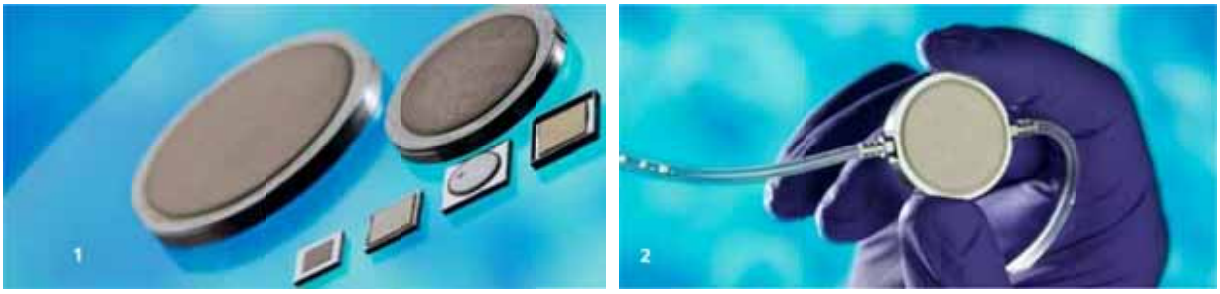
Applications and Technology of Piezo Driven Micropumps

Martin Richter

Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT, Munich, Germany.

Abstract. Piezo driven micropumps are the key component of microdosing systems, which enable new applications in consumer, medical, industry, automotive, chemistry and lab technology. They can be realized and manufactured by various materials, such as plastics, metal or silicon. Plastic micropumps can address cost efficient applications, metal micropumps mainly addresses high flow applications, and silicon micropumps can achieve high performance applications at a very small device size.

As the manufacturing cost of silicon micropumps at mass production scales linear with chip size, state of the art chip sizes of 7x7 mm^2 prevent the use of micropumps in medical disposable applications, as well as in consumer electronic devices. One important step for silicon micropumps is to miniaturize the chip size to reduce manufacturing cost. The reduction of the chip size to 5x5 mm^2, including strategies to realize mass production of silicon micropumps, will be explained in this presentation. A pilot application of a 5x5 mm^2 micropump in a mobile phone will be demonstrated.



The Fraunhofer micropump family.

Biography. Martin Richter´s mission is to enable microdosing systems for industrial applications. He completed his studies in technical physics at the Technical University of Munich, and gained his PhD at the University of Armed Forces in the area of microfluidics. Since 2000 he has been heading the Department Micromechanics, Actuators and Fluidics at Fraunhofer. His scientific focus is on microfluidic actuators such as micro pumps, micro valves, open jet dispensers or micro blenders, and integrating these in microfluidic systems. Such microfluidic actuators are deployed in varied applications, e.g. in medical technology (such as drug dosage, glaucoma therapy), laboratory technology or dosage of lubricants.

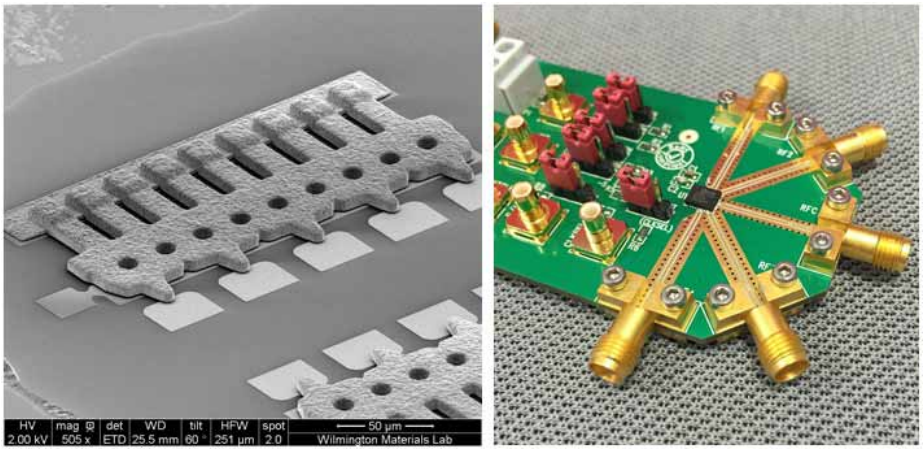
Successful Commercialisation and Release of the Analog Devices RF MEMS Switch

Ray Goggin

Analog Devices, Cork, Ireland

Abstract. The prospect of a highly reliable wide bandwidth compact MEMS switch being used in RF test instrumentation and other applications has been attractive for many years, and the road is littered with companies both large and small who have tried and failed to commercialize this illusive technology. Reliability and ease of use have been long standing challenges with the widespread adoption of MEMS switches and Analog Devices MEMS switch technology development in Ireland has concentrated on comprehensively addressing these issues.

In this talk, Ray Goggin, Design Engineering Manager and MEMS Switch technology champion within Analog Devices will share the story of how with constant focus on reliability Analog Devices has successfully commercialized an electrostatic MEMS switch in industry standard plastic packaging. He will share some of the important lessons learnt on this long journey to success and also discuss both the application level impact that MEMS switches are having on Analog's customers as well as the apprehension they had in adopting the technology. Finally the talk will show how in the future MEMS switches will be seen as game changing technology in multiple market segments.



The Analog Devices RF MEMS switch.

Biography. Ray has been with Analog Devices(ADI) in Ireland since 1997 when he joined as a graduate engineer from University College Cork with a 1H degree in Electrical & Electronic Engineering. Since that time Ray has held a number of roles in Test, Design, Marketing and Management in the Precision Products Group.
Most recently Ray has been the champion and leader of ADI's MEMS switch technology and ADGM1304 product development,overseeing this innovative breakthrough product/technology's successful commercialization and release.
Ray has presented technical papers on MEMS switches at multiple technical conferences, most recently at the International Microwave Symposium in 2015. Ray holds 10 US patents.

Technical Programme – Monday 29th August

Session A

11.00 *Poster Session A & Coffee*

12.30 *Lunch*

Session B

B8	**Alumina-based monopropellant microthruster with integrated heater, catalytic bed and temperature sensors** Zahra Khaji[1], Lena Klintberg[1], Dhananjay Barbade[2], Kristoffer Palmer[3] and Greger Thornell[1,2] *[1]Div. of Microsystems Technology, Dept. of Engineering Sciences, Uppsala University, Uppsala, Sweden* *[2]Ångström Space Technology Centre, Dept. of Engineering Sciences, Uppsala University, Uppsala, Sweden* *[3]SSC Nanospace, Uppsala, Sweden*	**48**
B9	**Inertial focusing of microparticles and its limitations** F. J. Cruz[1], S. Hooshmand Zadeh[1], Z. G. Wu[1,2] and K. Hjort[1] *[1]Engineering Sciences, Uppsala University, Ångström Laboratoriet, Uppsala, Sweden* *[2]State Key Laboratory of Digital Manufacturing Equipment and Technology, Huazhong University of Science and Technology, Wuhan, China*	**49**
B10	**Magnetic Multilayer Fabrication Technology with Selective Activation of SU-8 Films** R. Anthony[1, 2], C. Ó Mathúna[1, 2] and J. F. Rohan[1] *[1]Tyndall National Institute, Lee Maltings, University College, Cork, Ireland* *[2]Electrical and Electronics Engineering, University College Cork, Ireland*	**50**
B11	**CMOS-compatible fabrication of metamaterial-based absorbers for the mid-IR spectral range** Ehsan Karimi Shahmarvandi, Mohammadamir Ghaderi and Reinoud F. Wolffenbuttel *Faculty EEMCS, Delft University of Technology, Mekelweg 4, 2628 CD Delft, Netherlands*	**51**
B12	**High resolution patterning of liquid alloy by shrinking the substrate** Seung Hee Jeong[1], Albin Berglund[2], Frida Nilsson[2], Arne Sahlberg[2], Hugo Nguyen[1], Zhigang Wu[1,3] and Klas Hjort[1] *[1]Division of Microsystems Technology, Department of Engineering Sciences, The Angstrom Laboratory, Uppsala University, Box 534, 751 21, Sweden* *[2]The Angstrom Laboratory, Uppsala University, Box 534, 751 21, Sweden* *[3]State Key Laboratory of Digital Manufacturing Equipment and Technology, Huazhong University of Science and Technology, Wuhan, China*	**52**

15:00 *Poster Session B & Coffee*

16:00 *Paper Review Session @ The Sextant*

17.45 *Close of Day 1*

18:15 *Bus Transfer to Old Midleton Distillery*

18.45 *Distillery Tour & Tasting, Gala Dinner & Entertainment*

~23:00 *Return to Cork*

Technical Programme – Tuesday 30th August

Session C

11.00 Poster Session C & Coffee

12.30 Lunch

Session D

D7 **MEMS gas ionization sensor with palladium nanostructures for use at ambient pressure** **75**

L. Müller, H. Mehner and M. Hoffmann

Micromechanical Systems Group, IMN MacroNano®, Technische Universität Ilmenau, 98693 Ilmenau, Germany

D8 **Turbulence as the disturbing force in macroscopic self-assembly** **76**

P.A. Lothman[1,2], T.A.G. Hageman[1,2], A. Manz[1] and L. Abelmann[1,2]

[1]KIST Europe, Saarbrucken, Germany

[2]University of Twente, Enschede, The Netherlands

D9 **Extreme-temperature lab on a chip for optogalvanic spectroscopy of ultra small samples – key components and a first integration attempt** **77**

Martin Berglund[1,2], Zahra Khaji[1,2], Lena Klintberg[2], Anders Persson[1,2], Peter Sturesson[1-3], Johan Söderberg Breivik[1,2] and Greger Thornell[1,2]

[1]Ångström Space Technology Centre, Uppsala University, Sweden

[2]Div. of Microsystems Technology, Dept. of Engineering Sciences, Uppsala University, Sweden

[3]Dept. of Military Studies, The Swedish Defence University, Sweden

D10 **Characterization of a macroscopic self-assembly reactor** **78**

T.A.G. Hageman[1,2], P.A. Lothman[1,2], A. Manz[1] and L. Abelmann[1,2]

[1]KIST Europe, Saarbrucken, Germany

[2]University of Twente, Enschede, The Netherlands

D11 **MEMS Based Micro Aerial Vehicles** **79**

Niranjan Joshi, Elof Kohler and Peter Enoksson

Department of Micro and Nanotechnology, Chalmers University of Technology, Sweden

D12 **Frequency adjustable MEMS vibration energy harvester** **80**

P. Podder[1], P. Constantinou[1], A. Amann[2, 3] and S. Roy[1, 4]

[1]Micro-Nano Systems Centre, Tyndall National Institute, Cork, Ireland

[2]Photonics Centre, Tyndall National Institute, Cork, Ireland

[3]School of Mathematical Sciences, University College Cork, Cork, Ireland

[4]A.S. Paintal Chair Professor in Engineering, Indian National Science Academy

D13 **Location Dependence of a MEMS Electromagnetic Transducer with respect to an AC Power Source** **81**

Ruth Houlihan, Oskar Olszewski, Nathan Jackson, Finbarr Waldron, Mike O'Neill, Alan Matthewson

Tyndall National Institute, Lee Maltings, Cork, Ireland

15:15 Poster Session D & Coffee

16:30 Closing Remarks, Poster Awards and MME 2017

17.00 Close of Day 1

19:00 Informal Social Event (TBC)