EPIC Members Event Reports

µtas 2012

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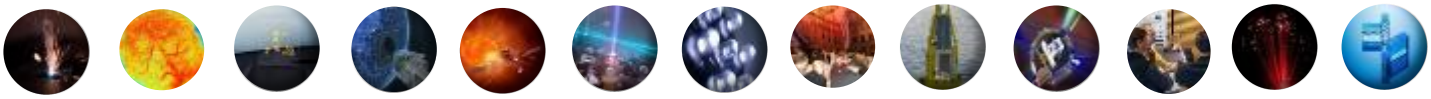
About the EPIC Members Event Reports

Initiated by the founder of EPIC Dr. Thomas Pearsall in 2003, these reports are prepared by members of EPIC to the benefit of the wider community. If you did not have a chance to attend the event but would like to know some key highlight, this report is for you. Emphasis is placed on exploring technical and business opportunities for the members of EPIC. If you are an event organizer and would like your event covered by EPIC, if you would like to volunteer for writing a report, or if you have any comments to this report, please contact info@epic-assoc.com



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The event was chaired by Prof. Teruo Fuji from the University of Tokyo. Now in its 16th edition, 664 poster presentations and 89 oral were selected among the 1200 submitted abstracts. In addition, 6 excellent plenary speakers, and a special session focused on ocean-related applications were held. Nowadays, this conference is considered among the related researchers as the premier forum for reporting outstanding advances and results in microfluidics, microfabrication, nanotechnology, integration, materials and surfaces, analysis and synthesis, and detection technologies for life sciences and chemistry [commonly summarized as micro total analysis systems (µTAS), or lab-on-a-chip (LoC)] . As these fields are experiencing a dramatic growth, the scope of the conference is expanding from microscale to nanoscale physics and chemistry, from molecules to cell and tissues, and from fundamental theories to devices and systems. With a clear view towards final application and paths towards industrialization, the scope of this conference covers areas ranging from clinical diagnostics to energy and environmental.

The importance of optics and photonics technologies in uTAS can be observed with the progressive increase of contributions to this conference in which optical and photonics are introduced, not only as detection methods, but also as inherent components suitable to provide with an outstanding accuracy and sensitivity. As an example, the plenary talk entitled "*Smart microparticles, partipetting, and liquid microarrays : from basic technologies to applications*", in which Prof. Kwon reviewed core basic technologies of partipetting, among which it could be highlighted the fabrication processes for obtaining high-quality optically-encoded micropartices with a high throughput. Then, he presented different strategies for simultaneous dispensing large number of different liquids into microwells with only one pipetting event. Another example of the progressive interest in optics and photonics within uTAS community was the specific session related to optics. Here, three talks addressed the integration of optical elements with microfluidics as a method to enhance the performance of commercially-available systems. This was the case presented by M.N. Gulari, which introduce the uOil concept to perform submicron imaging with wide view field using low cost stereo microscopes.

Ability to detect changes in shape of a given droplet inside a microchannel can provide information regarding the nature of the interaction between two different liquids as well as their relative interaction with the microchannel walls. This is of crucial importance when related to surface functionalization to detect specific analytes. Obtaining 3D images in such structures was accomplished in the work entitled "*real-time 3D shape measurement of micro droplet using digital holographic microscopy*", where the use of an off-axis holographic/interferometric optical system enables real-time volumetric measurement of arbitrary microscopic objects, with in-plane and out-of-plane resolutions of 1.1 µm and 62 nm respectively.

The session related to optics ended with a clear example of the current trend: mergence at the microscale of optics and photonics with other non-optical elements. In this case, Y. Kazama presented the integration of lithographic lenses, a fluidic channel, light shields, an optical fiber and the so called "caldera mirror" to obtain an integrated angle resolved spectroscopic device.

Interestingly, optics retook also the control in the session related to patterning, after several years where the predominant topic was soft lithography. Here, different approaches were presented. Firstly, A.T. Ciftlik demonstrated the wafer bonding using an intermediate Parylene-C bonding layer fluorescence (IPBLF) and its use as an on-chip medium for data storage by dynamic programming of IPBLF intensity. The main novelty of this technique is the possibility of the microfluidic chip to be read, written and erased by a standard fluorescent microscope. Similarly, in the work entitled "*Optical near-field induced chemical partial hydrophobic/ hydrophilic modification with sub-diffraction limit resolution*", T.H.H. Lee presented a method for partial hydrophobic/hydrophilic modification using the optical near-field (OnF) induced photocatalytic reaction. This allowed obtaining sub-diffraction limit resolution by photo-induced method that allows a new approach towards nanofluidic devices, in which the partial surface modification is required to exploit functional applications. Finally, a new polymer called OSTE was introduced that enables the fabrication of arbitrarily complex multilayered structures by self-bonding photopatterning.

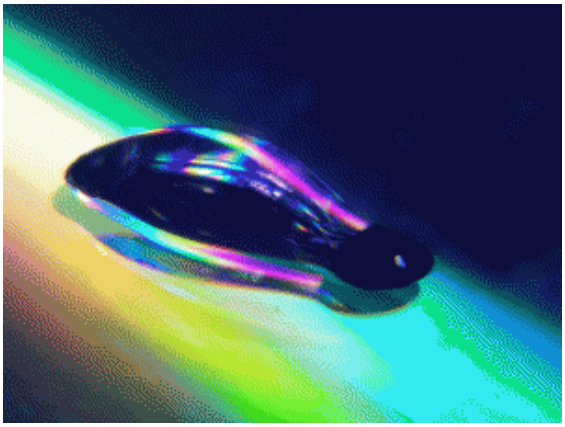
Also at the "detection" session photonic technologies obtained a pre-eminent position, which two out of three talks related to plasmonics. In the first talk, it was studied the relationship between surface-enhanced Raman spectroscopy (SERS) and the plasmon resonance. By using the deformation of an elastomeric membrane, the inter-particle distance may be changed, resulting in a tunning of the plasmon resonance frequency and therefore the SERS signal enhancement could be directly observed. With this approach, the authors claimed an extreme sensitivity to targeted analytes. In the second talk, R. Peng presented an immunoassay device, with integrated nanoplasmonic sensor array inside a microfluidic channel. As compared to a conventional 96-well plate immunoassay, the system he proposed showed a 106 fold detection limit enhancement of a model direct Protein A immunoassay and 6 fold of incubation time reduction.

Focusing towards final applications, photonic systems also showed a huge potential. In the work entitled "*Droplet-based liquid-liquid extraction and on-chip IR-waveguide-spectroscopy detection of cocaine in human saliva*", the authors presented a multiphase liquid-liquid extraction to transfer cocaine from IR-light absorbing saliva to an IR transparent solvent with the on-chip cocaine detection and their quantitative analysis by IR-waveguide-spectroscopy. In marine sciences, the use of laser-induced breakdown spectroscopy (LIBS) performed in situ, multi-element chemical analysis of liquids and immersed solids at sea. H.-W. Su presented experiments using LIBS on a remotely operated vehicle (ROV) at a depth of 200 meters with both liquids and immersed solids. Finally, optics and electrochemistry were merged in the MultiMEOC concept. Microscopic imaging of cells moving against electrodes was used to extract their electrical and optical properties.

Related to exhibitors, this year companies from around the world presented their ultimate equipment in Okinawa, with products ranging from microfluidics to data acquisition or polymers. Examples of outstanding products were the QMIX system from Cetoni GmbH, specially the spectrometer module lambda, which may be integrated in a modular way with the

rest of Cetoni products, including the Nemesys pumps. Seika also presented a particle image velocimetry in 2D (2D-PIV) and a very powerful Stereo 3D-PIV, which makes use a double pulsed laser.

As every year, several awards were given to outstanding works and careers within this community. Concretely, The Pioneers of Miniaturisation Lectureship (supported by Corning Inc) recognises outstanding achievements and significant contributions to the understanding and advancement of micro- and nano-scale science. This year, the award was given to Professor Andrew deMello at ETH Zurich, Switzerland. Among his many achievements and awards, he pioneered the application of high-contract fluorescence lifetime imaging to microfluidic environments. Finally, the Art in Science Award, whose main aim is "to draw attention to the aesthetic value in scientific illustrations while still conveying scientific merit" was given to Y. Zhang, from the Johns Hopkins University School of Medicine, USA for the image, entitled 'Stretching the Rainbow'.



Art in Science Award 'Stretching the Rainbow'.

Art in science award: Left to right: Michael Gaitan (NIST), Yi Zhang (winner), Harp Minhas (Lab on a Chip)

Pioneers of Miniaturisation: Left to right: Harp Minhas (Lab on a Chip), Andrew deMello (winner), Po Ki Yuen (Corning Inc)

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About Instituto de Microelectrónica de Barcelona (IMB) Centro Nacional de Microelectrónica (CNM)

IMB-CNM is the largest public microelectronics R&D centre in Spain. The National Microelectronics Center belongs to the Spanish National Research Council and its main activity is R&D in silicon-based micro- and nano-electronics. Founded in 1985, it is staffed by 220 people, about 65 of whom are researchers and about 60 Ph.D. students. The annual ordinary budget for 2010 was around 12 million € with income from external funding (contracted research and industrial projects) of around 42%. CNM is constituted by three Institutes: Instituto de Microelectrónica de Barcelona, IMB-CNM, Instituto de Microelectrónica de Madrid, IMM-CNM, and Instituto de Microelectrónica de Sevilla, IMSE-CNM.

About EPIC – European Photonics Industry Consortium

EPIC is a membership-led not-for-profit industry association that promotes the sustainable development of organisations working in the field of photonics. Our members encompass the entire value chain from LED lighting, PV solar energy, Silicon photonics, Optical components, Lasers, Sensors, Displays, Projectors, Optic fiber, and other photonic related technologies. We foster a vibrant photonics ecosystem by maintaining a strong network and acting as a catalyst and facilitator for technological and commercial advancement.

EPIC Members (1 February 2012)

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