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mAm 2019

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EAB MEMBER

Following nine successful previous editions of the annual Micronarc Alpine Meeting (mAm), the tenth once again took place at the Eurotel Victoria hotel in the idyllic Villars-sur-Ollon ski resort village. Located at 1,250 m altitude in the Swiss Alps, mAm 2019 offered participants spectacular panoramic views extending from Lake Geneva to Mont-Blanc as well as easy access to the ski centres.

Micronarc, the main organiser, was pleased to attract 72 participants, including a total of 13 sponsors and exhibitors. The continuing popularity of this meeting is testament to not only its high-level speakers and technical programme but also its quality networking, afforded by a casual atmosphere for discussion not provided by the larger, more formal conferences.

Microsystems- and MEMS-based products are in high-volume production for consumer applications, especially mobile phones, diagnostic and disposable medical devices for use in the rapidly growing healthcare industry. Overcoming the issues associated with sustainable production of, and meeting increased market demand for, these products is of continuing interest to manufacturers; solutions include improved tooling for precision parts and provision of highly efficient automated assembly lines and test systems.

Participants were welcomed on the first day by Prof Dr Volker Saile, from the Karlsruhe Institute of Technology (KIT) and former president of MANCEF, Danick Bionda, secretary-general of Micronarc, and David Kappeler, project manager at the Office for Economic Affairs, Canton of Vaud, Switzerland.

▶ *View from the Eurotel Victoria hotel.* ▶

The technical programme this year focused on innovative equipment, processes and technologies for the manufacture of microproducts, with keynote speakers addressing current and future developments. Single track sessions over two days included dedicated talks on the future of micromanufacturing, applications in medtech and watchmaking, sensors, and novel manufacturing.

The traditional mAm evening dinner was held at Restaurant du Col de Bretaye, 1,600 metres up a snow-covered mountain. At the beginning of the evening, Dr Yves Emery, CEO of LyncéeTec, delivered a visionary presentation entitled 'All that is impossible to do remains to be done' to mark the 10th edition of mAm. Later, delegates had the opportunity to mingle as well as enter draws to win the traditional Tissot watch and other gifts, which have been a highlight of the event over the years.

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▶ *Winner of the Tissot watch.* ▶

Programme

This year, 16 invited talks, of which 3 were given by keynote speakers, were selected on the basis of topics relevant to the programme. Outlines of a selection of the presentations in sessions by the keynotes and the invited speakers are provided below. Particular features of the programme were the reviews of various manufacturing technologies and the manufacture of new products.

The tabletop exhibition, being located next to the meetings room where the break was held, enabled everybody to network. It featured insights into new equipment and manufacturing processes. After each session, exhibitors were given a three-minute time slot to make their pitches.

Future of micromanufacturing I

Keynote: Mario El Khoury, CEO of the Swiss Centre for Electronics and Microtechnology (CSEM), Switzerland.

Talk: The Swissness of Industry 4.0: technologies that make the difference

This talk provided an overview of the European initiatives and programmes on the digitalisation of industry in 17 EU countries and the factors that are needed to maintain a strong economy. Data was shown on how manufacturing has declined in Europe by an average of 5 percent compared with China's increase of 39 percent over the past 20 years.

The role of digitisation in manufacturing was discussed and examples of manufactured products were given with reference to CSEM's three areas of focus, namely precision manufacturing, digitalisation and energy. Details of macQsimal, the European Quantum Technologies Flagship project for a new generation of sensors, was presented. A summary was given of CSEM's technologies for advanced manufacturing, artificial intelligence (AI) and other areas.

Micromanufacturing applications I: watchmaking

Keynote: Guy Sémon, director general, and Jason Lund, head of nanotechnologies at the TAG Heuer Institute, Switzerland.

Talk: 3D dilation: how to make watch components from scratch using thin films

A detailed description was given of the anatomy of a watch. The hairspring and balance wheel are the critical components that define the frequency of a watch. The three main classes of hairspring material used are metals, carbon composites and crystalline silicon.

An overview was provided of the benefits of the mechanical properties of carbon composite hairsprings and the new possibilities afforded by complex structures from carbon nanotubes. These materials offer advantages for the design of hairsprings and balance wheels, which are critical to the accurate timekeeping of watches. The material properties of carbon-carbon composites are governed by nanoscale processes. An understanding of these processes is required to be able to tailor the properties for a given application.

The hairspring technology described in this talk is available exclusively through the TAGHeuer Institute, which provides a platform for continuous innovation and improvement.

Micromanufacturing applications II: medtech

Keynote: Prof Dr André Bernard, head of the Institute for Micro- and Nanotechnology (MNT), University of Applied Sciences Buchs NTB, Switzerland.

Talk: Microfluidic device to model microvascular obstructions in heart attack patients

This talk focused on the Institute for MNT's facilities and equipment, and their use in an experimental project on fluidic modelling of coronary artery disease (CAD) and, in particular, microvascular obstructions (MVOs). CAD is the most common cause of heart disease-related deaths, accounting for 13.2 percent. There is a major demand for procedural diagnosis and treatment of MVO, which occurs in up to 60 percent of patients treated with a stent. Since there are no existing technologies for diagnosis and treatment of MVO, the objectives of the project were to: study the behaviour of fluid transport in the heart coronary vessels; build a microfluidic model; verify the model using animal studies; correlate flow parameters with physiological conditions; and design and optimise protocols and instrumentation for diagnosis and treatment of MVO.

The talk related the progress of the project, which involved collaborators from different institutes. It concluded with a summary of the results.

► *The conference.* ►

Sensors

Keynote: Benedetto Vigna, president of the Analog, MEMS & Sensors (AMS) Group, STMicroelectronics, Switzerland and Italy.

Talk: Sensors and Feynman roadmap

The work of STMicroelectronics during the last 20 years was summarised with a timeline of the various products developed. These were mainly related to sensors for the consumer and automotive industries. The progress in sensor technologies and applications as well as the growth of different markets since the early 2000s were given. Customised requirements of resolution, accuracy, stability and cost for the different emergent applications and markets such as autonomous driving—requiring light detection and ranging (LIDAR), radar, miniaturised cameras and personal electronics—were highlighted.

Future of micromanufacturing II

Keynote: Prof Dr Ulrike Wallrabe, head of the Laboratory for Microactuators, Department of Microsystems Engineering (IMTEK), University of Freiburg, Germany.

Talk: Adaptive optical elements with non-trivial shapes

This interesting talk covered both theoretical and practical aspects of adaptive optical elements. The properties of various lenses and mirrors were given, with slides illustrating a range of configurations. These included lenses and mirrors with different shapes and geometries partly available on the market, namely piezo lenses from the University of Freiburg, silicone lenses and glass lenses. In addition, drivers and control electronics were discussed.

The applications of such super-compact lenses and mirrors include imaging in NMR-microscopy, inspection and quality control, and others. The mirrors and mirror arrays allow for shaping laser beams.

Novel manufacturing I

Speaker: Jörg Pierer, project manager at the Swiss Centre for Electronics and Microtechnology (CSEM), Switzerland.

Talk: Real-time 3D MEMS inspection using a light field camera

Jörg Pierer talked about an EU Horizon 2020 programme to investigate and develop 3D MEMS inspection. Several technologies are available for this purpose, for example, X-ray, cameras or laser scanners. However, these exhibit serious weaknesses when applied to complex MEMS with 3D requirements in high-speed inspection.

Pierer presented his approach for inline inspection using a plenoptic/light field camera from Raytrix, highlighting advantages in several applications. To finish, he demonstrated the integration of the light field camera in VISARD, CSEM's software framework for automated inspection in 3D.

Future of micromanufacturing III

Keynote: Prof Dr Hendrik Hölscher, Institute of Microstructure Technology (IMT), KIT, Germany.

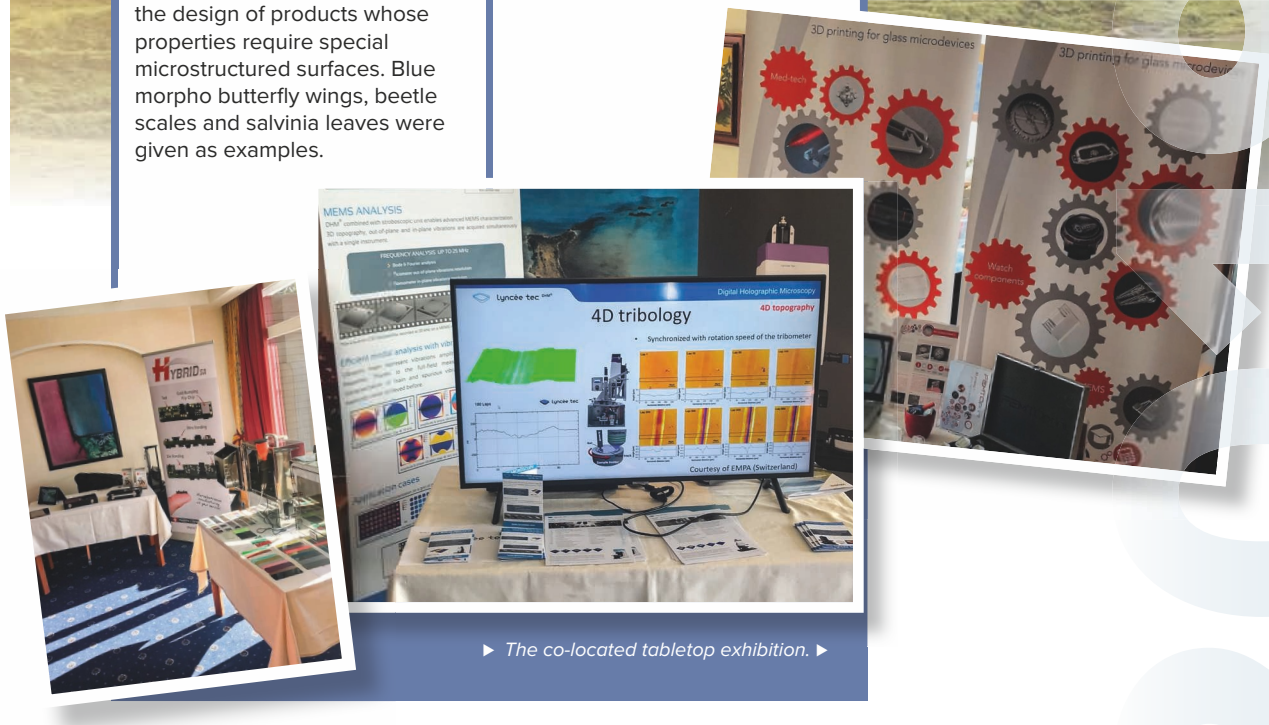
Talk: Bio-inspired nano- and microstructured surfaces: from analysis to fabrication and applications

This talk described how biomimetics, the study of how animals and plants have adapted and optimised their designs to complement their environments through evolution, has inspired the design of products whose properties require special microstructured surfaces. Blue morpho butterfly wings, beetle scales and salvinia leaves were given as examples.

Final summary talk

Prof Dr Saile gave a summary of the conference talks and Danick Bionda, secretary general of Micronarc, delivered the final remarks and brought the conference to a close.

Acknowledgements go to Prof Dr Saile for supplying the notes for this review and Edward Byrne, deputy director at the Swiss Foundation for Research in Microtechnology (FSRM), for supplying the accompanying photos.



▶ *The co-located tabletop exhibition.* ▶

The next mAm will take place at the Eurotel Victoria hotel on 9–11 February 2020.

mAm 2019
http://mam2019.ch/wp/