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inno · Innovative Technologies - New Applications

Micro and nano industry in Finland

Ilkka Kaisto

VTT Technical Research Centre of Finland is the leading research and technology company in the Nordic countries. VTT uses research and knowledge to provide expert services for domestic and international customers and partners. VTT develops new smart technologies, profitable solutions and innovation services.

In the field of printed and hybrid manufacturing, VTT has a team of over 90 experts working to develop printed electronics, diagnostics and indicators with a strong focus on roll-to-roll processes and pilot-scale manufacturing. Through pick and place assembly processes, printed foils can be further converted into flexible electronics, or so-called hybrid electronics, which utilize both printed and conventional electronics.

As a multidisciplinary organization, VTT is not limited to the development of printed components and sensors. In various cases, printed devices combine electronics, communication, software and services to enable real applications. For example, VTT has demonstrated a concept system for MS-disease medication support. The demonstrator consists of a disposable microfluidic immunosensor developed in-house. This optical readout device was developed as an add-on device for smartphones, which is also used to store information on patients' conditions based on their own input. The smartphone application also stores data via a cloud service, which can be used later by the patient and doctors.

Other appealing application areas for printed and hybrid electronics can be found in medical, health and wearable technology. In these applications, flexibility or a free-form factor is needed. Typical devices include flexible electrodes, functional patches glued directly onto the skin or various wearable devices or textile-integrated electronics. VTT has recently developed a manufacturing process in which elastomer integrated wearable devices can be manufactured based on a fully roll-to-roll process. This is enabled by the bonding of tiny flip chip silicon components onto roll-to-roll printed conductors. The flexibility of these structures enables the rewinding of the foils onto rolls, which can then be fed into an injection moulding process. This enables the use of fully automated roll form processing – minimizing labour costs.

VTT and PrintoCent partners have set up unique, award-winning pilot facilities that enable the upscaling of printed and hybrid electronics manufacturing to proof-of-production level.

PrintoCent commercializes printed mass manufacturing

PrintoCent community has been actively working since 2009 to create a strong business driven design-development-manufacturing environment for market trials, product concepts and solutions enabled by printed intelligence technologies. Currently, there are more than 300 experts working in this community, which comprises companies, start-ups/business cases in training/accelerator phase, universities and research institutes. Located in Oulu, Finland, the founding members - VTT Technical Research Center of Finland (leader), Business Oulu, Oulu University of Applied Sciences and University of Oulu – have all streamlined their efforts in printed intelligence for industrialization and commercialization.

| Focus: Micro and Nano Industry in Finland|

Content

Over 40 companies belong to the PrintoCent Industrial Cluster and are working in PrintoCent 2013–2015 programme to prove the ability to scale-up the roll-to-roll manufacturing technology. Oulu region with its dozens of companies has already proven to be an excellent location for printed intelligence product development as the combined annual revenue in 2014 was over 20 million euros while employing around 200 people in this field. In 2016, the corresponding figure estimation will be 50 million euros in revenue and 500 people employed, which clearly illustrates the rapid growth.➲

Editorial

Focus: Micro and Nano Industry in Finland

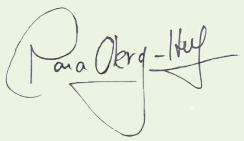
Welcome to the annual international issue of »inno«. This year, our international issue is dedicated to the Finnish high-tech industry.

The prestigious IVAM symposium ΣYSTEMS INTEGRATION took place in Finland this summer and was intergrated into the „Printed Super Week“, a series of events to present the rapid development of printed intelligence. This was the inspiration for this issue in which you will find technical articles from Finnish partners of IVAM like VTT Technical Research Centre of Finland and its members. The company Screentec Oy for example explains on page six how printed sensors can be used for intelligent applications.

VTT itself - host of this years ΣYSTEMS INTEGRATION - gives an overview about the microtechnology industry in Northern Finland. Furthermore you will find a more general view on the Finnish high-tech sector, provided by the German-Finnish Chamber of Commerce in Helsinki.

I wish you a pleasant reading!
Best regards

Mona Okroy-Hellweg



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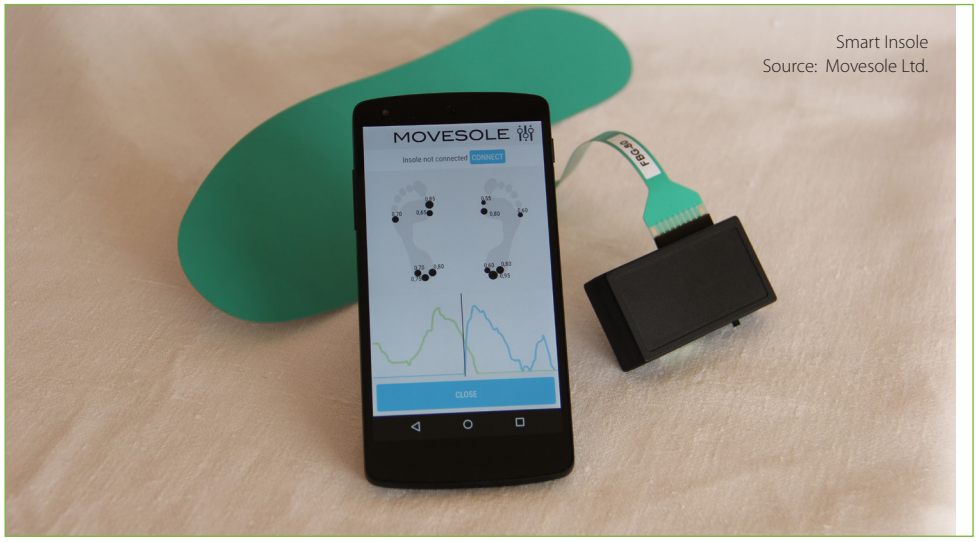
Editors:
Mona Okroy-Hellweg
Iris Lehmann
Dr. Thomas R. Dietrich

Contact:
Mona Okroy-Hellweg

Phone: +49 231 9742 7089
Email: mo@ivam.de



Smart Insole
Source: Movesole Ltd.

To further support the wide scale take-off of printed technologies, for instance, the PrintoCent Designer´s Handbook helps product designers to map the field and is also used in the topic education. The annual PrintoCent InnoFest gathers imaginative teams and experts to create novel applications and products around printed intelligence while supporting the birth of new start-ups. PrintoCent Industrial Seminars,i.e. the PRINSE–events every second year in Oulu, bring insight to industry needs and offering while providing companies an opportunity to build value chains and collaborate.

Oulu based company highlights

Goodwiller develops innovative and affordable diagnostics products for responsible and health conscious consumers. Their first product in is a reliable and easy-to-use alcohol test for people wanting to make responsible decisions in their life. Their competitive advantage is based on patent pending functionality and utilization of modern and cost-efficient manufacturing technologies that enable unique opportunities for differentiation.

Movesole got a notable boost from the first PrintoCent InnoFest and is now producing smart orthopaedic insoles to adjust and monitor leg mobility via underfoot pressure mapping on each step. The purpose is to hasten the recovery from lower-body injuries, while also helping athletes to fine-tune their running style. Immobilizing the movement is the fastest treatment for most injuries, but the speed and quality of recovery can be enhanced by progressively increasing the leg mobility with the help of Movesole Smart Insoles.

ECG-indicator
Source: Spektikor Ltd

Spektikor is the world’s first portable and disposable ECG-indicator to monitor vital signs of multiple patients at the scene of an accident, during transportation and at the Emergency Rooms. Spektikor indicates a patient’s heart rate with LED lights and a numeric display. It enables monitoring several patients simultaneously, even from a distance and under all circumstances. Spektikor is small, light and easy to use. Spektikor saves lives by saving crucial time for essential care.

Topographic Imaging
Source:
Focalspec Ltd

FocalSpec delivers laboratory-level topographic imaging for high-speed production lines. They provide sensors and system solutions for quality controlling of surfaces and transparent materials. The products are based on patented Lateral Chromatic Imaging (LCI) technology, which delivers extremely precise 3D and tomographic non-contact measurements of surfaces, plastic films and transparent multilayer structures. ➲

Diagnostics Manufacturing Automation
Source: Ginolis Ltd

Cloud demo for medical diagnostics
Source: VTT

Ginolis is a one-stop solution provider for Medical/IVD industries for the development and production of disposables. They produce cost efficient disposable test platforms combined with automatic manufacturing solutions for the global diagnostic and medtech industries. Ginolis outcompetes the existing automation providers with their modular approach enabling high margin and short delivery times.

Screentec is well-known developer and manufacturer of flexible substrate products. They have extensive experience in printing conductive inks on flexible materials with silkscreen printing. Their product portfolio consists of user interface products, lightning and illumination products as well as medical electrodes. Screentec serves professional equipment manufacturers and brands ranging from pulp&paper to professional automotive and medical sectors.

TactoTek manufactures 3D structural electronics by integrating printed circuitry and discrete electronic components into injection-molded plastics. Key aspects of device intelligence and functionality can disappear into the plastics themselves and become durable structural electronics. Their primary markets are IoT, personal electronics, automotive, medical devices as well as military.

VTT Technical Research Centre of Finland
www.vtt.fi
PrintoCent
www.printocent.net

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Strong and innovative – the Finnish high-tech industry

Mikaela Jaanti

Finland's stable economy is very attractive for high-level product development particularly in high-tech domains. Starting a business in Finland is easy. The country offers a highly educated workforce, public research and an efficient infrastructure. Development funding is readily available and the country has an excellent innovation and business environment.

Strong support from the Finnish government makes Finland a very attractive environment for startups. The Helsinki region, the capital region of Finland, has a pioneering position as a hosting location for many first-class high-tech companies' research and development centers, since 72% of foreign affiliated companies, 42% of their sites and 50% of their personnel in the country are located there. The region is rapidly growing into one of the leading tech startup hubs in Europe with the world leading venture capital investors such as Accel investing in local companies.

According to Statistics Finland, R&D expenditure amounted to EUR 6.68 billion in 2013. Expenditure increased by over EUR 40 million in the computer programming industry, consultancy and related activities, as well as research and development. Finland possesses diverse high-tech clusters all around the country. There are regions, which specifically concentrate on ICT and gaming or on cleantech, and regions focusing on healthcare and life sciences. Thus, Finland offers numerous research and development investment chances.

Top-level engineering

The level of Finnish engineering, production and logistic know-how is, in global comparison, on a top-level and covers everything from forest products to composites, lasers and nanomaterials. There are companies that specialize i.a. in designing, building and powering icebreakers, as well as building and equipping large cruise ships. Furthermore, numerous elevators in the whole world and cargo terminals depend on Finnish technology.

Nanotechnology

In the field of nanotechnology in Finland, one of the most important clusters for research and private enterprises in photonics has risen in the Joensuu region, in Eastern Finland. Especially Nanocomp Oy Ltd. has grown significantly in the area of component manu-facturing of nano-size optics. As a result of the world-class research level Japanese precision technology leader Olympus is involved in an important spectrum color technology research project in Finland. Also the European Optics Society decided to move its headquarters to Joensuu. The Joensuu campus of the University of Eastern Finland is the most important new institute of photonics recently established in the country.

The Helsinki region is home to several nano- and microtechnology companies as well as new materials expertise that accounts for up to 60 percent of Finland's resources. The region accounts for national and international significant industrial production sites, shows major organizations supporting innovative activities in these areas as well as top expertise in other scientific areas.

Life sciences

Due to the ever-increasing life expectancy the pressure on healthcare technology is becoming more and more evident. Finland's healthtech sector enjoyed its best trade year ever in 2014. In 2014, exports of health technology grew by 8.3% to a new record of EUR1.8 billion. With exports continuing to grow faster than imports, Finland's trade surplus in health technology products widened by 11% to a record amount of EUR 829 million.

Several Finnish products in the fields of dentistry and diagnostics are famous for their durability, innovation and performance. The Turku area in Western Finland covers approximately half of entire Finland's pharmaceutical industry. Turku also coordinates the Finnish HealthBIO cluster and is known for example for the Auria Biobank as well as medical data collection. This biobank is globally a groundbreaking source of knowledge and the first one of its kind in Finland. Besides Turku, also the Northern parts of Finland have a lot to offer: the Oulu region is famous, for example, for the world's leading brand of heart rate monitors, the world's first production method for recombinant collagen and products for faster development and scal-ing of biotech production processes. The Oulu LifeScience center comprises enterprises from the bio, health and welfare industries.

ICT

Mobile technology and advanced software in areas such as process and network automation have been an integral part of the Finnish high-tech industry for a long time. The industry's enterprises in Finland employ 48.000 people and have a combined turnover of EUR 7 billion. There are several strong, growing and developing ICT enterprises in the greater Helsinki region like in the city of Espoo and furthermore in other parts of the country like in the regions Oulu and Joensuu.

Source: © Felix Pergande - Fotolia.com

Furthermore, it's important to notice that while ICT remains an important area of expertise, an increasing number of small Finnish companies are making groundbreaking innovations in other fields of technology, such as data and software security. For example the city of Jyväskylä in Central Finland has an appealing cyber security cluster, and the Kainuu region in the northeastern part of Finland is said to be the Nordic focal point for data centers.

German-Finnish Chamber of Commerce

The German-Finnish Chamber of Commerce in Helsinki promotes economic relations between Germany and Finland. The primary task consists of supporting German and Finnish companies and organizations in creating new business relationships, with the help of their individually customized services. Within a new project the Chamber of Commerce offers co-working space in Helsinki for start-ups with a bonus of direct access to incubation networks in Germany.

German-Finnish Chamber of Commerce, Helsinki
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Printed sensors for intelligent applications

Antti Tauriainen

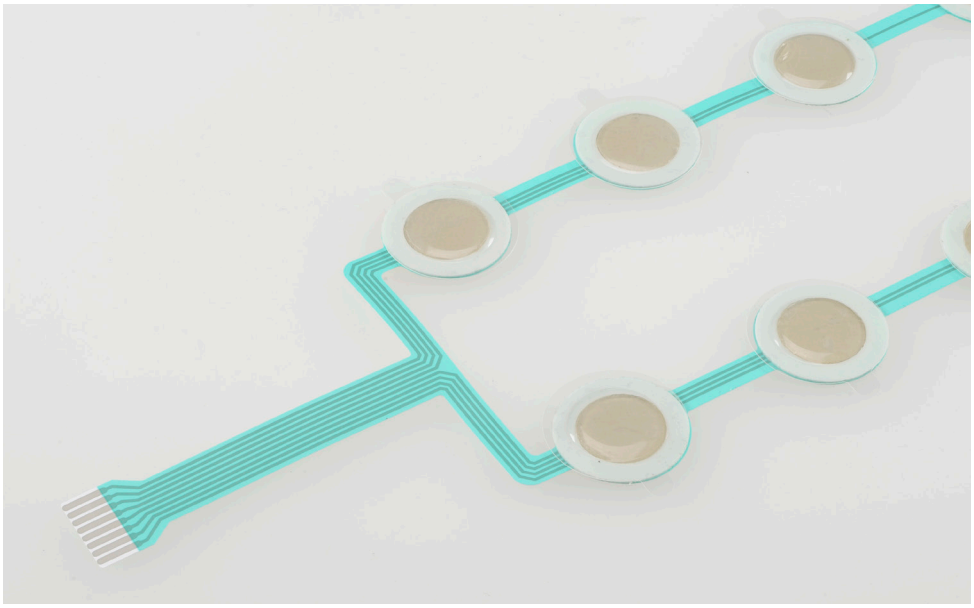
With introduction of home health care solutions and sensor networks, incorporated with - for example the Internet of Things - market calls for a multitude of solutions for flexible sensor solutions that can overcome challenges faced with traditional silica based sensors like size, disposability and on total costs.

While one trend is miniaturization other products and applications require in turn large area sensors to deliver best data in a cost-efficient way.

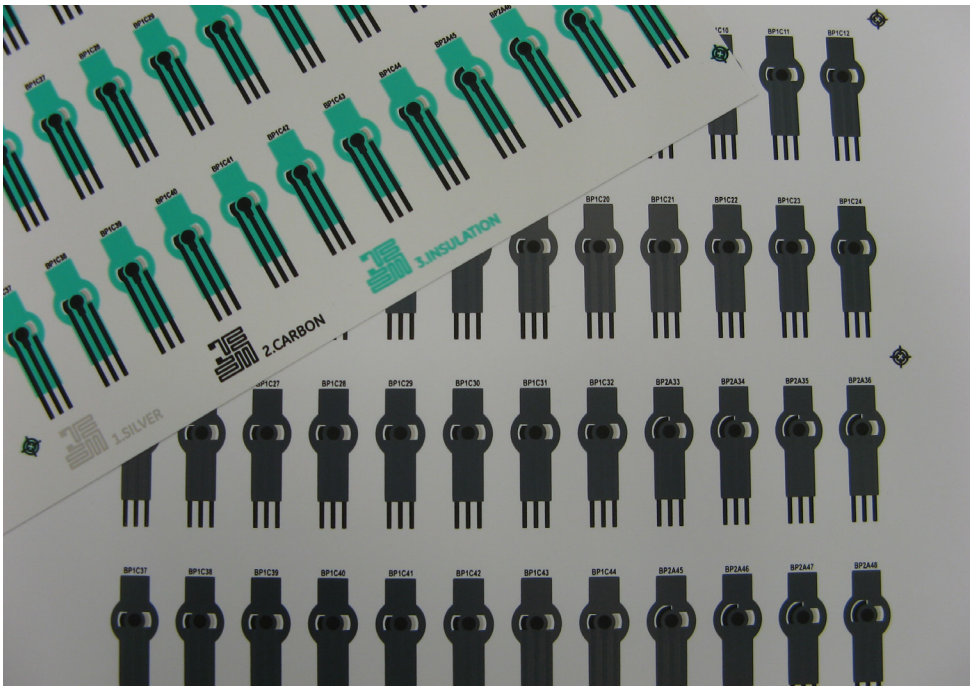
Choice of materials and printed layers

Plastic films such as polyethylene terephthalate (PET) and polypropylene (PP) offer well-known substrates to build various sensors on. Basic methods include printing conductive traces of material on the substrate to create sensors. By choice of materials and printed layers, different types of passive sensors can be produced, e.g. condensation, temperature and dew point - to name a few. Same type of sensors are applicable for biofeedback measurements ranging from heart beat sensoring to muscle activity. Strong points for the above-mentioned approach include the possibility to create large area sensors, which can be from square meters to tens of square meters in size, disposable and allow a high integration level for the building industry, quick set-up for process industry in case of ad-hoc measurements, maintenance surveillance and usability as well as time savings for the healthcare industry.

Recent developments in SMD processes also allow integration of traditional electronics to printed sensors either for inclusion of software and intelligence straight on the sensor or allowing wireless transfer of sensor data to cloud. While this approach can be a compromise on the cost level of the sensor it is more suitable for long term sensors, such as on moisture barriers or insulators on process equipment or to mitigate interference on sensor signals. For sensitive measurements it is possible to include EMC barriers and this can be done by printing without increasing thickness and weight of the sensor more than 10-30 %.



Large area muscle EMG sensor for back muscles measurement Source: Screentec Oy



Electrochemical sensors without chemicals suitable for e.g. water heavy metal measurements in amperometric measurement. Source: Screentec Oy

Fulfill specific measurement needs

Printed plastic sensors allow incorporating multiple different measurements. An example could be taken from liquid measurement where it is necessary to measure pH, temperature, and other chemical substances e.g. heavy metals from one source. This is possible with printed sensors. The sensors' work environment depends on the chosen materials but as a rule of thumb -20 to +60 degrees Celsius are easily achieved, whereas a work environment with over +90 degrees Celsius is only possible with the right material choices. Materials and sensor designs can also be optimized to be integrated into end products in main production without multiple additional process steps like building insulating materials.

While printed sensors will not solve every problem, they give new venue to combine strong points of one or two worlds – large area plastics and cheap integrated microprocessors to create new service applications. Printed sensors alone can offer a good customization level for specific measurement needs that is integrable into existing manufacturing processes - to create new values for maintenance or welfare.

Screentec Oy, Oulu, Finland
www.screentec.com

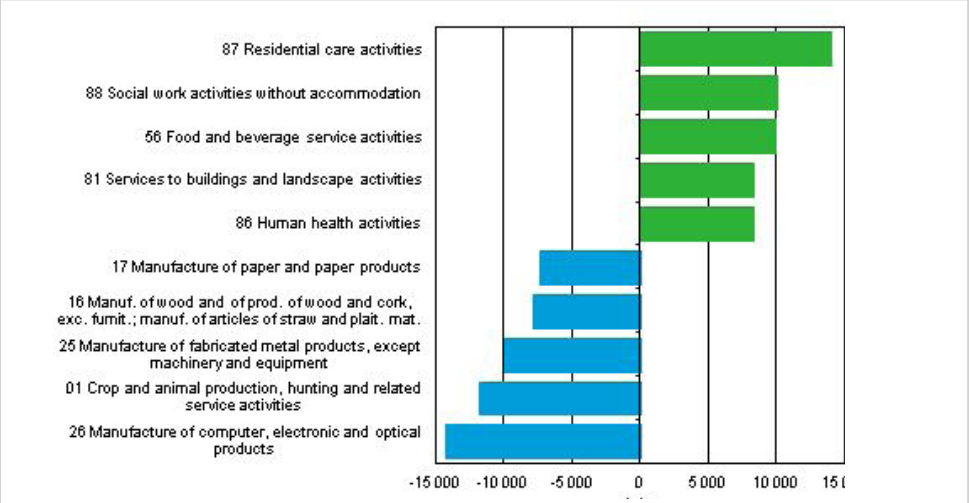
Finnish economics and linkage between printable technology and printing facilities

Teemu Pärnänen

Finland and other European countries suffer from the same industrial dilemma. The traditional manufacturing jobs are moving to cheap labour countries and perhaps closer to the new markets. The Official Statistics Finland show a change of Finnish economy and industry.

Due to the fact that Finnish economy relied on pulp and paper industry, metal industry and Nokia's mobile phones, the global rapid change of consuming media affected its supporting leg in a way that was not predicted by many. And the change is not yet over. This has caused unemployment and demographic issues all over the country. According to Trading Economics, in May 2015 the unemployment rate in Finland was 11,8%. To compare, in Germany the unemployment rate in May 2015 was 4,7%. OECD states accordingly: "Strong growth, innovation and structural reforms in the decade preceding the global economic and financial crisis transformed Finland into one of the world's most competitive economies, ensuring a high level of well-being for its citizens. More recently, however, competitiveness has deteriorated and output has fallen, as electronics and forestry collapsed. The latest settlement between social partners for modest wage increases over the next two years will help. More broadly, economic revival requires building on impressive human capital, strong institutions and sound macroeconomic and financial management to strengthen growth and increase integration in global value chains."

In order to overcome these problems Finnish industrial companies need to create new high-tech innovations or develop the traditional industry more sophisticated. Printed intelligence is perhaps one opportunity.



Change in the number of jobs in industries with the highest increase and decrease in the five-year period from 2007 to 2012 Source: Official Statistics of Finland (OSF): Employment [e-publication]. ISSN=2323-6825. Background information on unemployed persons 2012. Helsinki: Statistics Finland [referred: 26.7.2015].

Traditional printing and printed intelligence:

The printing methods used today have been innovated over a century ago. Gravure printing was first introduced in 1843, offset printing in 1875, flexo printing in 1890s and screen printing in 1910. These printing methods are still the most common to use in printable electronics. There are millions of such machines all over the world in paper, cardboard, textile and other substrate printing. Printing facilities print books, magazines, gift card and packages and other printed products. By a look at Finnish printed intelligence cluster PrintoCent's website, there are 44 members in the group. By a closer look at the member list one can notice that there is not a single firm, which is already active in traditional printing industry. At the same time both, traditional industry and printing branch suffer from a global industrial reform mentioned in the previous chapter. It seems that in Finland the printing facilities haven't found the printed electronics as a new affordable business.

Printing facilities have traditionally focused on the own business branch, where the core competences have been production efficiency, production lead time and quality. When the most modern printing machinery produce equal quality in almost equal time, the only way to survive the industrial change is to improve production efficiency. In most cases the printing facilities have forgotten to ask themselves: could we produce something more profitable with our machinery? They possibly have capital but no ideas where to invest. They surely already have working customer basis and channels to introduce new products and ideas to the end customers. Companies in printed electronics are in most cases start-ups with a research background. When interviewing the founders in these start-ups one usually finds out that they are little aware of traditional printing and might not have any connections to these firms. These firms might have wonderful ideas in new product development and knowledge to develop new innovations, but companies in printed electronics don't see traditional printing facilities as a viable business partner. They might think that the printing houses live in the past producing products, for which the demand is decreasing in the future. No wonder – the printing facilities have been unsuccessful in finding new products to manufacture with the printing machinery. When the researches and start-up companies have new product ideas they should interact more closely with printing companies. All in all, the innovation might be worthless if the end customer is not willing to pay for it.

Source : Prem

Printed electronics can be applied to packaging, gift cards, textiles etc. RFID-tags, lights or detection systems increase the attractivity of the regular products. In order to avoid the industrial change there is a need to develop new products combining the regular printing and start-up ideas. Technology clusters have a big role in this process.

Prem, Keuruu, Finland, www.prem.fi

Injection-molded structural electronics

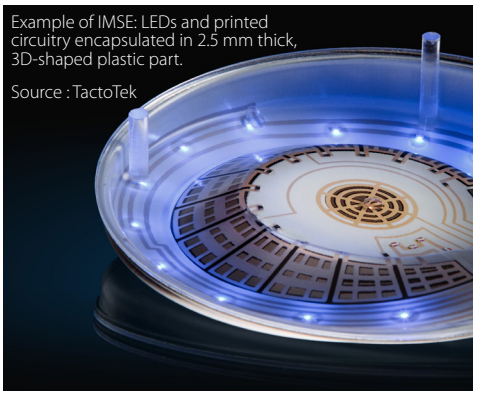
Dave Rice

Integrating electronics directly into the materials with which we build to create "smart structures" has been an elusive goal that is now being realized with injection-molded structural electronics.

Traditional construction vs. structural electronics

Since the inception of electronic products they have been shaped by a shared design requirement: a flat circuit board protected within a structural enclosure. It's a design pattern that has served, and constrained, products in categories ranging from consumer electronics and white goods to automotive controls, and even wearable technology.

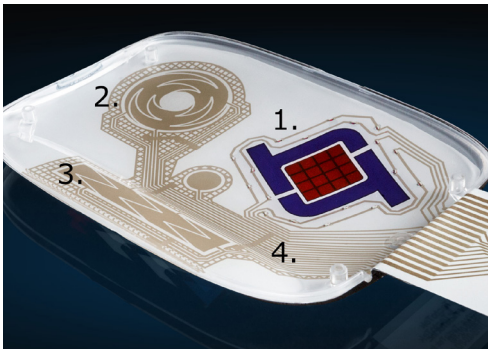
There are many different approaches to structural electronics; among the most versatile and relevant for mass-produced products is Injection-Molded Structural Electronics (IMSE). IMSE moves some, or all, of the electronics (ICs, LEDs, etc.) from a separate circuit board inside of the device to being immersed inside of the plastics that form the surface structure. IMSE is not a laminated solution, but one in which the electronics are introduced into the injection molding process resulting in plastic completely immersing and encapsulating circuitry and electronic components. Often these structures include electronics for sophisticated illumination, touch controls and local processing while enabling light, thin 3D designs.



Use cases leading adoption

Prominent use cases for structural electronics include innovative lighting design, human machine interfaces (HMI) such as control panels, and flexible wearable technology. Some key building blocks of these solutions include flexible printed circuitry, printed touch controls, surface mounted electronics and a printed wiring harness (if needed), all of which are encapsulated by high pressure, high temperature injection-molded plastics.

Because injection-molded electronics are fully encapsulated in plastic, they benefit from the protective and structural properties of that material. Circuitry and electronics are sealed from the environment and protected from shock and moisture; meanwhile, the type of plastic resin used to mold the part, as well as the shape and wall thickness of the design determine the extent of impact protection. TactoTek has examples of IMSE that are fully-functional when frozen in a block of ice for two days at -20 C, immersed in boiling water for an hour, and after the impact of a 16 pound (over 7.25 kg) iron ball dropped from a meter in height.



Device cover, front and back side: 1. LED-illuminated symbol window with animated effects, 2. Printed capacitive touch wheel, 3. Printed capacitive slider, 4. Printed circuitry. Source: TactoTek

Designed for mass production

There are different approaches to manufacturing Injection Molded Structural Electronics. TactoTek's IMSE manufacturing process integrates well-known mass production technologies, including in-mold labeling, electronic component surface mounting, thermoforming when needed, and injection molding, to create a new solution: 3D smart molded structures. In addition to printed circuitry, these structures also incorporate discrete electronic components such as LEDs, and ICs (accelerometers, communications, processors, and more.)

To minimize adoption barriers, TactoTek has developed its technology with an eye toward mass production efficiencies. One example of this approach is that TactoTek uses standard capital equipment through all aspects of the production process including printing, surface-mounting electronic components, forming and injection molding. TactoTek also uses materials familiar to product engineers and designers, for example typical molding materials include polycarbonate (PC) and acrylic (PMMA) for rigid designs, and for flexible components, thermoplastic polyurethane (TPU).

Transitioning to injection molded structural electronics

Realizing the full benefits of IMSE, both in form factor and functional possibilities as well as cost, typically requires re-thinking the design of a product or component. For example, simply replacing the surface plastics of an existing design with IMSE can enhance functionality, but misses the opportunity to reduce the thickness of the overall structure and shift electronics off the circuit board to where they're used. To help quickly evaluate IMSE for specific use cases, TactoTek has a team that works in partnership with customers to identify design objectives and collaboratively evolve designs to meet design and cost objectives with an IMSE solution.

High value benefits

Today, IMSE is most compelling for use cases that emphasize design differentiation, thin structures, low mass, and/or durability. For example, illuminated control surfaces using traditional designs often require a minimum depth of 25mm whereas similar functionality can be delivered using IMSE with a structure 3mm thick; as added benefits, IMSE eliminates several components, reduces weight, and simplifies assembly. In-Mold Structural Electronics encompass a set of quickly evolving technologies that will transform product design and function in several categories. Early IMSE examples are on the market today in vehicles, consumer electronics and more – it's the intelligence encapsulated within plastic surfaces.

TactoTek, Kempele
www.tactotek.com

ΣYSTEMS INTEGRATION 2015: Insights into Finland's high-tech printing industry

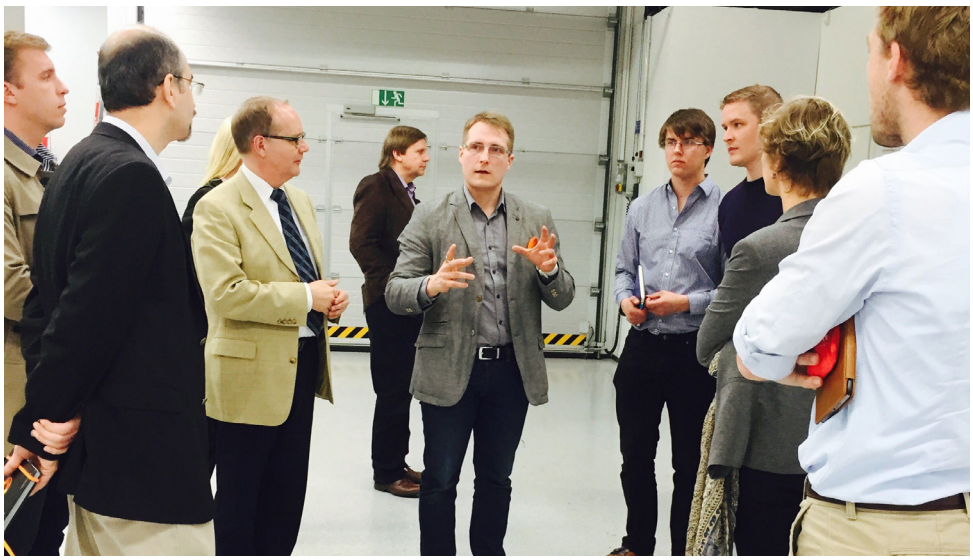
Dr. Thomas R. Dietrich

Since its inception eight years ago, the IVAM event series ΣYSTEMS INTEGRATION has given manufacturers and users of microtechnology an opportunity to share their ideas on the intelligent application of MST solutions. On June 9-10, 2015, the renowned symposium was held in Oulu in Northern Finland to discuss "Printed Electronics", "Printed Diagnostics" and "3D Printing". VTT – Technical Research Centre of Finland acted as the partner and host for the 2015 event.

VTT and its network PrintoCent constitute Europe's biggest focal point for research institutes and businesses with operations in the relevant fields. As part of the Finnish "PRINTED SUPER WEEK", ΣYSTEMS INTEGRATION was embedded in diverse start-up and networking events with "Printed Electronics" as their topic.

Nokia shaped Northern Finland

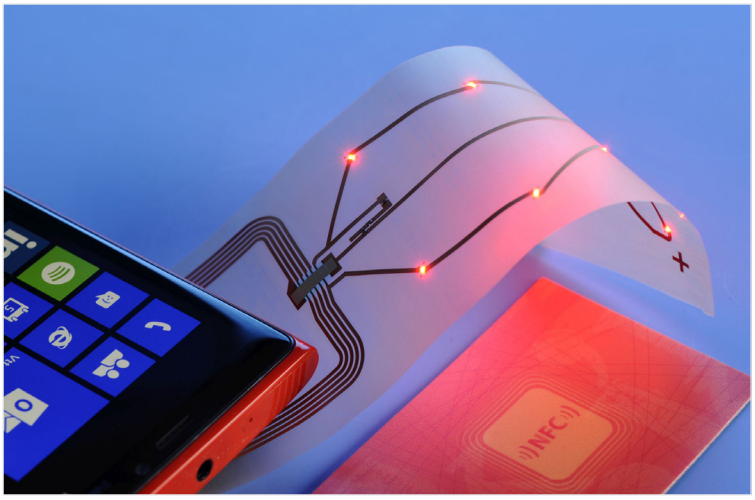
ΣYSTEMS INTEGRATION began with company visits in Oulu. The first trip led to FocalSpec who have developed optical methods and devices for surface topography measuring, especially in electronic components. How much of an impact Nokia's early operations have had on Oulu's business landscape becomes abundantly clear. Ginolis, for example, evolved from JOT, former prime machinery manufacturer for Nokia's production facilities. Today, Ginolis focuses on the manufacture of point-of-care (POC) diagnostics. A combination of microfluidics, chemistry, electronics and printing technology enables Screentec to deliver new and interesting products, such as single-use medical products or environmental sensors, all manufactured using silkscreen printing processes. Closing the tour, Tactotec showed how far the evolution of printing technology has come already: printed sensors, LEDs and circuitry, all shaped and integrated in injection molded plastic housings. Any structure is easily shapeable, shock proof and aesthetically appealing.



Source: IVAM

Presentation program shows opportunities and room to improve

During the conference program on day two, presentations and workshops explored the different aspects of the new technologies. Dr. Kari Rönkä presented the capabilities of VTT, especially in tandem with its network PrintoCent. The network offers development and prototyping of products, from OLED, organic photovoltaics, microfluidics, printed transistors and bio batteries to sensors, utilizing all available printing technologies. Especially the mass production capabilities of technologies like the roll-to-roll (R2R) process proved impressive.



Source: VTT Technical Research Centre of Finland

The Oulu University of Applied Sciencs offers its R&D partners different printing processes, for example, inkjet printers, dispensers for pastes or screen printing equipment for the development of an electrochemical biosensor.

The presentations showed the diverse possibilities of modern printing technologies. In medical technology, for example, orthopedic sensors for measuring foot pressure strain during leg injury rehabilitation proved to be an exciting prospect. The company Wrapplight presented bracelets with integrated LEDs for the sports and lifestyle sector. Mr. Mansoor Siddiqi from India introduced sensors that measure and display the state of food packaging, for example to measure temperature stress during transport or the CO_2 content in softdrink bottles.

Jaakko Raukola of KeepLoop presented another fascinating application: utilizing a simple, very small set of lenses, it is possible to transfer images to smartphones – fifty times enlarged. Fraunhofer ENAS showcased printed antenna structures capable of automatically opening parking lot gates or garages from inside the car. However, there is always room for improvement, as shown in ➲

the presentation of Dr. Tapio Fabritius of the University of Oulu. He focused primarily on the development and measuring of features of printing materials, fluids and inks.

The convention clearly showed that 3D printing in conjunction with Printed Electronics will constitute a major stepping stone on the way to "smart production". The new technologies will soon be capable of manufacturing any arbitrary custom products without long development periods, at a reasonable cost even in small batches.

Andreas Gryglewski from Bosch Rexroth pointed out that an accurate planning of all process steps is required in advance. With the featured software "Virtual Commissioning" the production processes of R2R processes are simulated in detail in advance to detect and eliminate errors before the implementation. How successful these new production concepts can be implemented, was impressively demonstrated by Dr. Alireza Parandian from the Belgian company Materialise: With appropriate software, any three-dimensional structures with integrated functional elements (eg LEDs) can be produced in a short time. In the future, the software will be so easy to use that design specifications can also be specified by users, even by end users.

Following the event, all participants agreed that contacts between members of IVAM and VTT/PrintoCent need to be intensified and expanded. At this year's COMPAMED in November, IVAM will once again organize the COMPAMED HIGH-TECH Forum with a focus on "Printed Electronics", where Finnish and German companies have the opportunity to showcase their products for medical technology.

IVAM Microtechnology Network
VTT Technical Research Centre of Finland
http://www.ivam.de
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Company and product news

Sub-micron chip packaging on wafer level

The new FINEPLACER sigma is the first assembly and bonding platform to combine sub-micron placement accuracy with a working area suitable for 300 mm wafer substrates and bond forces up to 1000N. This combination of features makes the bonding platform well-suited for Wafer Level Packaging (FOWLP, W2W, C2W), high-precision 2.5D and 3D IC packaging, MEMS/MOEMS/IR/image sensor assembly and all kinds of high I/O count applications. With it comes FPXvision, a newly developed Vision Alignment System designed to provide maximum optical resolution at all magnification levels. Real-time optimized camera images help to represent smallest structures across the whole surface, even for large components and substrates. As a first in a manual die bonder, FPXvision introduces optical pattern recognition. When aligning chip to substrate, pattern recognition is used to provide precise position feedback for a software-assisted verified alignment process. This ensures reliable alignment results due to minimized operator influence The FINEPLACER sigma's modular system architecture enables individualized machine configurations. New process modules and technologies can be retrofitted dependent on requirements. Advanced bonding technologies such as vacuum soldering, sintering or metal diffusion bonding (Cu/Cu) can already be realized for R&D and prototyping in numerous industries, such as medical technology, automotive, or aerospace.

Source: Finetech GmbH & Co. GK

Finetech GmbH & Co. GK, Tobias Gleichmann , Email: tobias.gleichmann@finetech.de, www.finetech.de

Modular Dosing System for continuous production

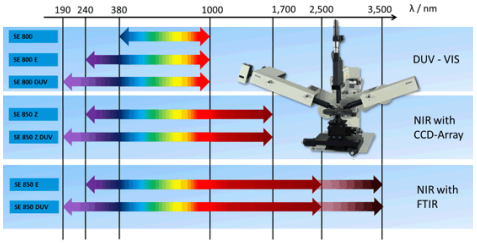
The Modular Dosing System (MoDoS) from HNP Mikrosysteme is a tailor-made pump system for continuous delivery in fine chemical and pharmaceutical production. MoDoS is synonym for a design concept and a modular component system, forming the base for the concept development of a customized pump module. The current development of Flow Chemistry, from lab research passing through pilot plants, up to production scale, opens new possibilities for fine chemical production. Small structures allow carrying out reactions in previously inaccessible process windows. Temperature, pressure and mixing ratios, which were not possible in classical batch procedure, can now be successfully implemented. In contrast to previous times, lower flow rates of higher concentrated chemicals are used for the purposes of resource conservation. Holistic turnkey pump system solutions such as MoDoS facilitate the integration into the system and give the planner the opportunity to deal more intensively with the actual process. The special value for the customers of the modular solutions of HNP Mikrosysteme is set in particular, in the integration of carefully selected and proven fluid power system components. The necessary know-how is the basis for a stable and process-reliable operation of the overall system. Heart of the system is a micro annular gear pump. Depending on customer requirements, pumps of the hermetic inert series or the high performance series are used. Further modules among others are filters, sensors and flow meters. The rapidly mass flow control ensures high process stability and constant volume flows of 1 µl/h to 1152 ml/min.

Micro annular gear pumps are the heart of the modular dosing system MoDoS
Source: HNPM

HNP Mikrosysteme GmbH, Dörte Hoffmann, Email: doerte.hoffmann@hnp-mikrosysteme.de, www.hnp-mikrosysteme.de

10 times faster spectroscopic ellipsometer

SENTECH offers leading-edge ellipsometers for thin film metrology and plasma equipment for etching and deposition. The SENresearch family represents the high end of spectroscopic ellipsometers and includes the unique combination of FTIR (Fourier Transform Infrared) spectroscopy and multiplex diode array spectrometry for spectroscopic ellipsometry. The ellipsometers make use of both spectroscopy techniques and the step scan analyser principle for detection and offer the widest spectral range ellipsometry, the highest resolution, and best signal-to-noise ratio. The big advantage of multiplex detection is speed. To fulfil highest requirements SENTECH improved the SENresearch FTIR ellipsometer to measure faster in the NIR, offering highest spectral resolution and widest spectral range with excellent signal-to-noise-ratio in shorter measurement time. The spectroscopic ellipsometers measure more than 1000 pairs of (Ψ, Δ) between 240-2500 nm in less than 10s applying ultrafast FTIR spectroscopic ellipsometry. This means 10 times faster measurements compared to state of the art solutions. In addition to the increase of measurement speed, the company expanded the spectral range as far as 2500 nm. The lower limits are 190 nm with Deuterium-Halogen light source and MgF_2 optics, 240 nm with Deuterium-Halogen light source and quartz optics, and 380 nm with Halogen light source.



Source: SENTECH Instruments GmbH

SENTECH Instruments GmbH, Email: info@sentech.de, www.sentech.de

Call for Papers: Smart Systems Integration Conference SSI 2016

Just several years ago Frost and Sullivan pointed out that smart is the new green. The concept of "Smart Earth" is, in fact, the in-depth application of a new generation of network. The Internet of Things, including smart grid, smart health, smart city, smart buildings, smart home, smart production and smart mobility provides not only big opportunities but is requesting more highly integrated smart systems from the hardware side. The total number of connected devices is expected to grow rapidly. Electronic components and systems are a pervasive key enabling technology, impacting all industrial branches and almost all aspects of life. The Smart Systems Integration Conference has been a pioneer in this shift towards smartness. And so, the Smart Systems Integration Conference 2016 is already the 10th edition. Within the keynote sessions two main topics will be addressed. The first one is the hardware side of the Internet of Things. The second one is printed, large area, flexible and stretchable electronics. Papers can be submitted until October 5, 2015.

Fraunhofer-Institut für Elektronische Nanosysteme, www.smartsystemsintegration.com

Company and product news

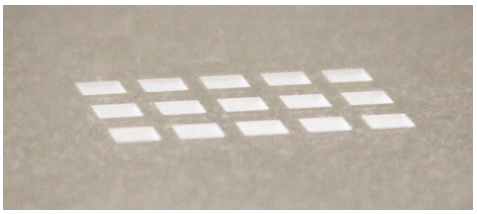
Plan Optik AG implements high accuracy laser patterning technology

Plan Optik AG, leading manufacturer of glass, quartz and glass-Si compound wafers has added laser patterning to its structuring techniques recently. Glass, quartz (e.g. fused silica) and silicon can be patterned generating an extremely high accuracy. Laser patterning is used for small feature sizes down to 20 microns. Patterning of different layer depths typically requires different process runs. Between each run, alignment to the previous layer is mandatory. In laser patterning, different layers will be processed in one run. No alignment will be necessary which increases layer to layer accuracy dramatically.

Compared to other common patterning techniques such as wet-chemical etching or sand blasting, laser patterning enables much higher aspect ratios and leads to a much better accuracy and very smooth patterned edges. Even pre-cutting or dicing into small dies can be materialized. Laser patterning works directly from the customers' layout file which could be .dxf, .gds or .dwg. Other file types could typically also be used after converting them. This enables a very fast and cheap prototyping since no masks are needed.

Plan Optik AG implemented laser patterning in addition to it's already existing bulk micro machining methods. Together with wet etching, ultra-sonic drilling, diamond tool drilling and sand blasting the company is now using all relevant glass and quartz surface micro machining methods in-house. This makes Plan Optik the one stop shop for all patterned glass and quartz parts for MEMS and semiconductor applications.

Plan Optik AG, Markus Wagner, Email: m.wagner@planoptik.com, www.planoptik.com



Source: Plan Optik AG

Intelligent quality assurance with NanoFocus confocal 3D measuring systems

Along with conventional 3D microscope systems NanoFocus offers surface metrology systems for inline use. With various options for automation they can be flexibly integrated into production lines for 100%-control or near the production lines for single or serial sample inspection. Measurement results can be directly transferred to pre-defined evaluation protocols or exported to further relevant software via various data interfaces (i.e. SECS-GEM interface). Result data is available for nominal/actual comparison or can be exported for further analysis to qs-STAT, Matlab, various data bases or SPC-charts. Industrial requirements are fulfilled by functions such as wafer map import or OCR/DDM/Bar Code Reading.

In serial measurements no user intervention is required thanks to features such as fiducial recognition, automated alignment and measurement range tracking. Measurement data and analyses are permanently stored in an analysis library and are available for statistical process control and an optimized documentation.

NanoFocus successfully supplied automated measurement systems to renowned manufacturers in different industries. Amongst these are systems for fully-automated wafer inspection in semiconductor manufacturing, serial control of joint implants and dental implants in medical technology and the measurement of microwelding and critical surfaces on automotive components.

NanoFocus AG, Claudia Delto, Email: delto@nanofocus.de, www.nanofocus.de

One example of 4.0-ready metrology systems of NanoFocus: Fully automated wafer inspection with sensors of the µsprint-product line.
Source: NanoFocus

New 3D ready-to-use white light interferometry system for the highest accuracy in surface inspection and quality control

With the KORAD3D family of robust white light interferometers, ISRA Vision and 3D Shape are already well established in the optical inspection technology market. The portfolio has recently been expanded to include the youngest family member KORAD3Dplus, specifically designed for the most precise measurements even in the most complicated and demanding environments. Its robustness allows for deployment close to or as a part of manufacturing lines and thus provides a valuable contribution to an efficient and quick quality control. The stand-alone system comes with an embedded PC, an integrated xy table and is fully encapsulated to prevent dust and dirt from polluting components. Vibration isolators take care of the necessary damping. As the lighting and camera are in a coaxial position, the cylindrical measuring light allows for scanning of any deepened areas like boreholes, trenches and etched structures. When scanning plane surfaces with components, like electronic hardware, the height information can be efficiently used as a very fast check for completeness. The examined surface can either be recorded as a whole or compiled by connecting successive pictures through "stiching". The sensor is able to scan any defined surface sequentially and thus reaches a measuring field of 150 x 150 mm². The height adjustment has a range of 100 mm and therefore allows the measurement of even the largest components. The system can be added to a production chain as an automated part or, thanks to its easy one-touch menu, manually operated by a worker. The flexible and robust system is put to best use in the production of components in different materials as well as in compound measurements as is needed in the glass manufacturing industry or in laboratory or medical technology.

ISRA VISION AG, Nicole Rüffer, Email: nrueffer@isravision.com, www.isravision.com

Encapsuled key components combined with long calibration intervals ensure a very low maintenance effort.
Source: ISRA Vision

IVAM trade shows and events

IVAM RoundTable
October 1, 2015, Berlin, DE
Host is WISTA-MANAGEMENT / Berlin Adlershof
www.ivam.de

IVAM Focus Group Meeting "Wearable Electronics"
October 2, 2015, Berlin, DE
Smart Textiles & Wearable Sensorics
www.ivam.de/focusgroups

IVAM Focus Group Meeting "Marketing"
October 22, 2015, Hamm (Westf.), DE
www.ivam.de/focusgroups

Medical Creation Fukushima 2015
November 11, 2015, Koriyama City, JP
www.ivam.de

COMPAMED
November 16-19, 2015, Dusseldorf, DE
International leading trade fair for suppliers of medical manufacturing. IVAM will present the Product Market "High-tech for Medical Devices" as well as the "COMPAMED HIGH-TECH FORUM".
www.ivam.de

IVAM Focus Group Meeting "Medical & Microfluidics"
December 2, 2015, DE
www.ivam.de/focusgroups

LaserForum 2015
December 3, 2015, Göttingen, DE
www.ivam.de

nanotech 2016
January 27-29, 2016, Tokyo, JP
IVAM organizes the German pavillion.
www.ivam.de

MD&M West 2016
February 09-11, 2016, Anaheim CA, USA
IVAM organizes a joint pavilion at the focus area MicroNanoTechnology
www.ivam.de

HANNOVER MESSE
April 25-29, 2016, Hanover, DE
The world's largest industrial fair - IVAM will again present the Product Market "Micro, Nano & Materials".
www.ivam.de

Hospitalar
May 17-20, 2016, Sao Paulo, BR
23rd International Medical Exhibition.
www.ivam.de

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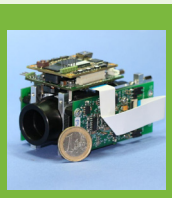
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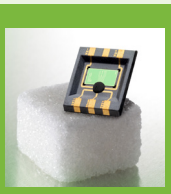
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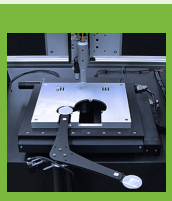
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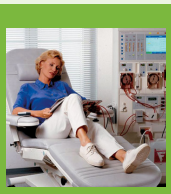
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