



The European Institute for the PCB Community

EIPC SPEeDNEWS

The Weekly On-Line Newsletter

Issue 14 – May 2023

NEWS FROM THE EIPC

Join us at the upcoming EIPC Summer Conference in Munich!

If you have never been to Munich, then you are probably not working in the PCB industry. Well, you may be, but then if you have never attended Productronica or Electronica, a bi-annual gathering in Munich of the illustrious companies who are the foundations of it, then that's a shame. But here is your chance. The EIPC are holding their Summer Conference there on 15th & 16th June, which is not far off now.

For the EIPC holding a conference in Munich is like an away match at home, and if we can draw you in then it's a win-win result for everyone. That includes those not only the other spectators, but the peerless speakers from all around the world who will be very pleased to see you, as will we. So too, will BMW World.

The conference will have papers from Custer Consulting, Adeon/CIMS, Elsyca, Circuit Foil, Ventec, Göttle, SAT, Emma Hudson, NanYa Plastics/Technolam, and others. We will also be having a Round table for Roadmapping.

Registration for the conference is open: www.eipc.org

Conference location:

Munich Marriott Hotel
Berliner Strasse 93
Munich 80805, Germany

Bonus and Evening Programma

On the afternoon of Thursday June 15, we will visit BMW World and in the evening we will have our Networking Dinner in a wonderful Restaurant in Munich area. Transportation by bus is arranged.

Conference Day 1, Thursday June 15		
08:00-08:30	Conference Registration and Table Top & Poster Exhibition build up	Table Top & Sponsor Lounge
08:30-08:45	Welcome by the EIPC President	Alun Morgan, EIPC, UK
Keynote Session 1: Business Outlook		Moderator: Tarja Rapala-Virtanen, EIPC, FI
08:45-09:15	Business Outlook: Global Electronics Industry	Alun Morgan obo Custer Consulting, USA
09:15-09:45	Interconnect Reliability in Electronic Systems	Dr. Donkai Shangguan, Fellow - IEEE, IMAPS, USA
09:45-10:15	Supporting PCB supply chain under the EU chips act	Stan Heltzl, ESTEC, The Netherlands
10:15-10:30	Q&A	
10:30-11:00	Coffee break @ the Table top & Sponsor Lounge	
Session 2: Smart Manufacturing (Industry 4.0)		Moderator: Dr. Michele Stampanoni
11:00-11:20	Real Time Integration of Design-, and Production generated Process Results, CIMS AOI systems	Andre Bodegom, Adeon-CIMS
11:20-11:40	Digital twin concept in Cu electroplating processes for better process control and superior metal finish	Agnieszka Franczak, Elsyca, BE
11:40-12:00	A guide to converting existing European PCB Fab facilities to 100% ZLD/Green processing	Alex Stępiński FRSA, Stepinski Group, USA
12:00-12:20	A new 3D finite element modeling approach to compute copper roughness supplementary loss in PCB.	Benoit Wittmann, Circuit Foil, LU
12:20:12:30	Q&A	
12:30-13:30	Lunch	Restaurant Marriott Hotel
Session 3: Special Material Solutions		Moderator: Emma Hudson, EHTC, UK
13:30-14:10	CCL Challenges in E-mobility applications	Andreas Folge, NanYa Plastics, DE Volker Klafki, Technolam, DE
14:10-14:30	IMS Thermal Performance: The Secret's in the Test Method	Robert Art, Ventec Europe, DE
14:30-14:50	Development stable dielectric performance and low modulus CCL for Automotive Radar Application	Yonghyon Kim, Doosan Corporation Electro Materials, KR
14:50-15:00	Q&A	
15:15-16:30	Departure & Tour Group 1 to BMW World	
15:15-16:30	Group 2 Networking Table Top & Sponsor Lounge Marriott Hotel	
16:45-18:00	Departure Group 2 to BMW World	
16:45-18:00	Group 1 Networking Table Top & Sponsor Lounge Marriott Hotel	
19:00-22:00	Departure Marriott Hotel Lobby - Networking Dinner	

Conference Day 2, Friday June 16		
Session 4: Supply Chain and Metrology		Moderator: Oldrich Simek, Pragoboard, CZ
08:30-08:50	The Bullwhip effect, from crises to crises	Gerd Appelt, Göttle GmbH, DE
08:50-09:10	General UL update	Emma Hudson, EHTC, UK
09:10-09:30	Metrology for Advanced PCB and ICS Manufacturing	Uwe Altmann, KLA-Orbotech, BE
09:30-09:50	Smart Design – sustainable solution for automated and optimized Cu balancing	Agnieszka Franczak, Elsyca, BE
09:50-10:05	Q&A	
10:05-10:35	Coffee Break @ Table Top & Sponsor Lounge	
Session 5: Solder Mask applications and Surface Finishes		
10:35-10:55	Application for Digital Ink Jet Printing of Solder Mask for Flex Circuits	Hans Fritz, SAT, DE
10:55-11:15	Next Generation Solder Mask for Automotive	Harald Kutzius, Taiyo America, USA
11:15-11:35	Selection Criteria of Surface Finishes for Better Reliability of Next Generation Electronic Assemblies	Dr. Kunal Shah, LiloTree, USA
11:35-11:50	Q&A	
Session 6: Round table for Roadmapping		Moderator: Alun Morgan, EIPC, UK
11:50-12:50		
12:50-14:00	Lunch	Restaurant Marriott Hotel





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NEWS FROM GERMANY

ILFA invests in Schmolz drilling and milling machine A-RMXY2-60S-CCD

by F.Schwarz
ilfa.de

Our latest addition to our machinery and equipment is used in our department for drilling and milling technology (BFT): The A-RMXY2-60S-CCD from Schmolz Maschinen GmbH. With its performance and equipment, the drilling and milling machine is also a real high-end solution in other respects.

We are only the second PCB manufacturer in Europe to use this machine with numerous additional applications in production. With it, we realise high-precision depth milling with a tolerance of $\pm 5 \mu\text{m}$. A high-resolution CCD camera is used for optical registration, which automatically detects a wide variety of surfaces such as copper, tin or gold.

The system also has an automatic loading and unloading system. Thus, only the loading has to be taken care of, the drilling and milling machine performs its tasks autonomously and up to 10 different product configurations can be run. The drilling or milling depth is controlled by an integrated measuring system in the Z-axis motor. In our equipment version, the machine also has a vacuum adapter and a measuring probe (touch probe).

Thanks to the high precision in depth milling, the machine supports us specifically on our technological growth course, which envisages investments in the double-digit millions for the Hanover location. In the first step, the drilling and milling machine will support us in the production of printed circuit boards for sensitive medical technology.

atg A9a Flying Probe Technology for High-speed Electrical Test and Automation shipped to Summit Interconnect in Orange, California.

atg Luther & Maelzer GmbH

atg Luther & Maelzer GmbH, confirms delivery of high-speed bare board testing technology to Summit Interconnect in Orange, CA.

Summit is the largest privately held PCB manufacturer with 8 facilities in North America and specialises in the manufacturing of advanced technology with focus on complex rigid and rigid flex products with unique expertise in RF / Microwave applications for the Commercial, Aerospace and Defence industries.

Consistent with the on-going investment in leading edge technologies at Summit Interconnect, the fully automated A9a, 8 head, double-sided, high speed, high accuracy flying probe test system represents the latest addition to Summit Inc. Test department. The new atg technology enables Summit Interconnect to test ultra-fine designs while helping to reach industry leading automation goals.

The atg A9a is able to test pad sizes down to 35 micron and is capable of testing products up to a size of 21" x 24". The A9a eliminates limitations due to test point density or fine-pitch contacts and also features embedded component test, 4-wire Kelvin measurement capability with an accuracy of +/- 0,025 microns, HPOT and latent testing. In combination with a test speed of up to 230 measurements/second, the A9a provides a "Lights-out" automated handling solution for larger production runs. To achieve high throughput the key feature of the A9a is a dual shuttle system, which reduces the product exchange time to zero seconds in automation mode.

atg Luther & Maelzer GmbH, a member of Mycronic AB (Sweden) is the leading supplier of electrical testing solutions for the printed circuit board industry.

Infineon and SCHWEIZER extend cooperation in chip embedding to develop more efficient silicon carbide automotive solutions

Infineon Technologies AG (FSE: IFX / OTCQX: IFNNY) and Schweizer Electronic AG (ETR: SCE) are collaborating on an innovative way to further increase the efficiency of chips based on silicon carbide (SiC). Both partners are developing a solution to embed Infineon's 1200 V CoolSiC™ chips directly into printed

circuit boards (PCB). This will increase the range of electric vehicles and reduce the total system costs.

The two companies have already demonstrated the potential of this new approach: They were able to embed a 48 V MOSFET in the PCB. This resulted in a 35 percent increase in performance. SCHWEIZER contributes to this success with its innovative p² Pack® solution which enables power semiconductors to be embedded in PCBs.

“Our joint goal is to take automotive power electronics to the next level,” said Robert Hermann, Product Line Head Automotive High-Voltage Discretes and Chips, of Infineon. “The low-inductive environment of a PCB allows clean and fast switching. Combined with the leading performance of 1200 V CoolSiC™ devices, chip embedding enables highly integrated and efficient inverters that reduce overall system costs.”

“With Infineon’s 100 percent electrically tested standard cells (S-Cell), we can achieve high overall yields in the p² Pack manufacturing process,” said Thomas Gottwald, Vice President Technology at Schweizer Electronic AG. “The fast-switching characteristics of the CoolSiC chips are optimally supported by the low-inductance interconnection that can be achieved with the p² Pack. This leads to increased efficiency and improved reliability of power conversion units such as traction inverters, DC-DC converters, or on-board chargers.”

Infineon and SCHWEIZER will showcase the 1200 V CoolSiC chip embedding technology at PCIM Europe 2023 in Nuremberg, at the Infineon booth 412 in Hall 7. SCHWEIZER will also be at the trade fair (booth 410 in Hall 6).



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NEWS FROM ITALY

FOCUS ON PCB fair will be held in Vicenza on 18TH and 19TH of May 2022 and it will be the only European fair dedicated to the world of PCBs and PCBAs in its premier opening.

FOCUS ON PCB fair will be held in Vicenza on 18TH and 19TH of May 2022 and it will be the only European fair dedicated to the world of PCBs and PCBAs in its first edition.

During the fair, conferences and forums will be organized with the main players and experts in the sector to analyze the characteristics and potential of a rapidly expanding market.

“Focus on PCB ” will therefore allow PCB users to have a complete picture of the Italian companies that produce PCBs and PCBAs that assemble them, in this way it will be possible to share know-how and innovative ideas useful to the entire sector. Atg electronics will be present with stand 208 in hall 1 and will host the company LUMINOVO, creator of a latest generation software, able to obtain availability and price of components in real time.



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NEWS FROM NORWAY

CONFIDEE further expands its presence

Establishment of office in Italy, appointing Andrea Queirolo as Sales Manager Italy.

CONFIDEE are proud to announce the appointment of Andrea Queirolo as Sales Manager Italy. This strategic move is aimed at expanding the company's reach in the European market.

“We are thrilled to further expand our presence in Europe and welcoming Andrea to our team. With his extensive experience and industry knowledge, we are confident that he will be an invaluable asset to our company as we continue to grow and serve our customers as a trusted PCB partner, protecting the supply chain,” says CEO Vidar Olsen.

His experience in the PCB industry spans over three decades, positioning him as one of the most experienced figures in the Italian market. Queirolo brings a wealth of knowledge and expertise to the team. He will be responsible for driving growth and strengthening relationships with customers in Italy.

“I am excited join the company and contribute to increase the business in Italy. CONFIDEE is founded on solid values with a focal point on compliance, however the focus is always to be the strongest partners for our customers, providing them with the best possible PCB solutions, helping them achieve their business goals”, said Queirolo.

In his new role, Queirolo will work closely with customers to identify their specific needs and provide them with compliant PCB solutions that meet their unique requirements. He will also be responsible for building and maintaining relationships with key industry players and identifying new opportunities for growth.



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NEWS FROM THE UK

Semiconductor Industry Update Webinar Registration Now Open

When will the current market downturn come to an end? Will the overall market decline be single or double digit? Will the automotive and industrial markets save the day? What is the outlook for 2024? Find out the answer to these and other key questions at Future Horizons' Semiconductor Industry Update Webinar, **May 9, 2023** - 3pm UK BST (GMT+1). Site licence for corporate library or multi-user use available. <https://www.futurehorizons.com/page/136/Industry-Update-Webinar>

Registration

https://us02web.zoom.us/webinar/register/8516814791234/WN_R2-3Z5QLSxmYYDYDs9H4iw

Why?

Founded in 1989, Future Horizons' forecast track record and industry experience makes this a must-attend event for key decision makers in the semiconductor, electronics and all related industries. We are also never afraid take a contrarian view where necessary, backed up by firm data and sound analytical process.

What You Will Learn

This one-hour broadcast will focus primarily on the 2023 semiconductor industry forecast and outlook for 2024, including:

- How will the downturn play out in the short and medium-term
- What are the key indicators to look out for moving forward
- How to build resilient strategies and business models

As always, the presentation slides will be mailed out an hour before the webinar with ample opportunity to ask questions in advance, during and after the event.

Who Should Attend?

- All companies, small and large, from startups to established market leaders
- Key decision-makers engaged in the design, fabrication or supply of semiconductors
- Government organisations involved in trade and investment
- Those involved in investing or banking within the electronics industry
- Senior marketing executives planning future marketing strategy

Can't Attend Live?

Sign up to receive the slides and a recording of the live event for subsequent viewing

Why Future Horizons?

We have been in the business of forecasting and analysing the semiconductor market for over 55 years and have been a trusted advisor to governments, investors and most of the top global semiconductor firms. Time and time again we have delivered sound advice and saved our clients time and money with our forensic and accurate analysis of the industry.

For a small investment of £150 plus £30 UK VAT you will gain accurate industry insight to make good strategic decisions in these uncertain times

- Site license option for unlimited company participation
- Please pass to a colleague if already attended or not suitable for you
- This event can also be held in-house for your added convenience and flexibility

Malcolm Penn
Chairman & CEO

IMAPS-UK FREE WEBINAR

Monday 12 June 2023 at 13:00 (UK time)

Reducing the Environmental Impact of Photonics and Electronics

Dr. Jeff Kettle, University of Glasgow

Photonics and electronics manufacturing requires a transition to more sustainable practices. This webinar highlights the latest life cycle assessments and the challenges in the fabrication processes that must be addressed to reduce environmental impact. A method to improve the recovery of critical materials at the end of life will be introduced.

For any other details or information please contact:

IMAPS-UK Secretariat

125 High Street Chesterton, Cambridge, UK

Tel: +44 0131 2029004

e-mail: Office@imaps.org.uk

Silicon Chip Industry Awareness Workshop Seminar

Unlock Your Potential Today!

Whether you're a non-technologist struggling with the jargon or a specialist looking to understand the overall industry structure, this workshop is for you. Join us on Tue 6 June 2023, 9:30am to 4:00pm at the Holiday Inn in Kensington, London. Gain a competitive edge in the Semiconductor Industry by learning how the IC industry works from the science that enables silicon chips to be made from sand to the market fundamentals that drive applications and economics. Experience the industry through Listen, Discuss, See, Touch, and Learn activities and enjoy improved job satisfaction and operational efficiency.

Priced at just UK£695 plus 20 percent UK VAT per delegate, the fee includes copies of presentation materials, coffee breaks and lunch. Workshops can also be held in-house for your added convenience and flexibility. To preserve course integrity space is limited, so don't wait – Secure Your Spot Today at:

<https://www.futurehorizons.com/page/12/silicon-chip-training>

Past Attendee Comments

- * As a non-technologist, it was very beneficial to have these issues so clearly explained
- * The seminar provided a good basis to understanding the industry
- * It was GREAT! I can't remember a day of a similar density
- * I finally understand how to recognize products & their use in technology
- * This has helped me structure my thoughts & plans for the company
- * It gave me deeper insight into the industry in a way difficult to obtain anywhere else
- * This will be very useful when involved in our core business development discussions



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PCB INDUSTRY NEWS

U.S. Crawls toward Rebuilding Frail PCB Industry

Exclusive Interviews

By [Alan Patterson](#) 04.27.2023 0

—Part of this EE Times series: **A Vulnerable U.S. Electronics Supply Chain**. Other articles in the series include: [Experts: U.S. Military Chip Supply Is Dangerously Low](#) and [Reshoring Chip Industry Risks Failure With Just More Fabs](#).

Recent efforts by the U.S. government to rebuild the nation's nearly extinct printed circuit board (PCB) industry are tentative and inadequate steps toward one of the weakest links in the domestic electronics supply chain, experts told EE Times in exclusive interviews.

On March 24, U.S. President Joe Biden and Canadian Prime Minister Justin Trudeau announced that both nations would contribute funds to support the North American manufacture of critical technologies that include semiconductors. The agreement earmarked \$52 million for PCB production.

On March 27, Biden issued a determination that action to expand domestic production of PCBs under the Defence Production Act (DPA) is necessary to avert a shortfall of critical technology that would severely impair national security.



David Schild (Source: PCBAA)

“The DPA, which is a law from the early 1950s, allows the government to much more quickly—and without a lot of red tape and bureaucracy—do things that it deems critical for national defence and national security,” David Schild, executive director of the Printed Circuit Board Association of America (PCBAA), told EE Times in an exclusive interview. “What you see is the White House saying, ‘We’re going to categorize PCBs under DPA.’ It gives the Pentagon now the ability to spend money that we’ve already allocated.”

The U.S. portion of global PCB production has plunged to 4% today from 30% about 25 years ago, according to data provided by PCBAA. During the same period, China’s share has soared to 54% from 8%. The global PCB market, worth \$78 billion in 2021, is forecast to nearly double to \$128 billion by 2030, according to Precedence Research.

Now, most of the boards that connect chips and other parts in electronic systems—ranging from data centers to drones—are made in China, the [main strategic adversary of the U.S.](#) For longer than six years, China and the U.S. have been engaged in an intensifying cold war to achieve dominance in technology.

Embargo scenario

“To avoid a scenario where we get embargoed on PCBs, the amount of capacity that would be needed is just staggering,” Hari Pillai, president of the Technology Components Group at Sanmina, told EE Times in an exclusive interview.

Sanmina, one of the largest U.S.-based PCB makers, counts on defence-related production for about 60% of its business. And it would have difficulty boosting output to meet a wartime surge in demand.

“We couldn’t quadruple our shipments in the U.S. [on short order],” Pillai said. “I don’t think any competitors are sitting around with a lot of idle capacity in the U.S.”

Vulnerabilities go beyond PCB gap

The effort to fill the [PCB gap](#) underscores a range of vulnerabilities in the U.S. electronics supply chain running from [chips](#) to [semiconductor packaging](#) and on down to the board level.

To revive the U.S. PCB industry, domestic manufacturers must count on more than defence sales; they will need to gain a larger share of the high-end commercial business for boards used in computing, communications and medical systems. That's where another legislative proposal—the Supporting American Printed Circuit Boards Act of 2022, a.k.a. HR 7677—could help.

The U.S. government efforts last month create “more awareness and support for things like HR 7677,” Pillai said. “HR 7677 could result in two to three cutting-edge [PCB] fabs being built in the U.S.”

The proposed act—which was introduced on May 6, 2022, in a previous session of Congress but didn't receive a vote—would provide \$3 billion in funding to expand production. Building an advanced PCB fab is a two-year process that costs as much as \$400 million. By contrast, a state-of-the-art chip fab costs as much as \$20 billion to build.

Though the bill was not enacted, its provisions could become law by being included in another bill.

The [Supporting American Printed Circuit Boards Act](#) of 2022, a.k.a. HR 7677, was sponsored by these U.S. representatives who remain in office today: Anna Eshoo (D) of California, Blake Moore (R) of Utah, Dina Titus (D) of Nevada, and Frank Mrvan (D) of Indiana. (Source: EE Times)

In addition to PCB-fab-building, H.R. 7677 also would offer demand-side stimulus through a tax deductibility element, allowing buyers of U.S.-built PCBs to get tax relief, Pillai said.

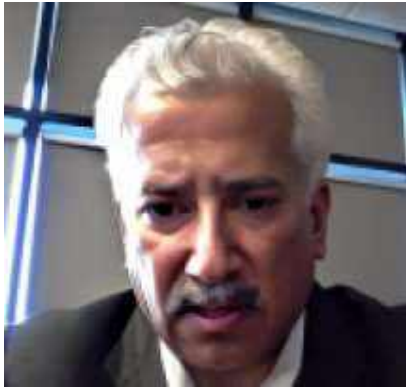
“It's the right balance of incentives—so that not everything is funded by the government, by joining with private money to help reduce and even the playing field a little bit with the Chinese,” he added.

Every board shop that's left in the U.S. is servicing commercial or aerospace and defence markets, and they're facing “really stiff competition” from foreign suppliers, PCBAA's Schild said, noting that foreign governments provide heavy subsidies on land, facilities and labour.

A fragile, complex ecosystem

PCB manufacturing is a part of the electronics ecosystem that's as complex as semiconductor production.

Innovation in PCB design helps electronic systems perform at higher speeds. A circuit board is like a freeway that connects processors with high-speed data, Pillai noted.



Hari Pillai (Source: Sanmina)

"We're doing a lot of work pushing the envelope in terms of improving signal integrity and allowing faster speeds," he said. "We are doing a technology called 'back drilling.' It's not very common in the industry. It allows us to achieve higher levels of signal integrity, which allows [companies] like Google and Facebook and HP to achieve faster computing. That innovation is also a benefit to Raytheon and Northrop Grumman and weapons processors and systems."

The decline of the PCB industry threatens an infrastructure of materials and technology suppliers in the U.S., according to Pillai:

"I see this erosion of the circuit board business, but it takes with it the supply base in terms of high-speed laminates with dielectric materials that can achieve the performance levels that we're trying to achieve."

Dire warning issued

The U.S. PCB industry is very close to extinction, according to Schild.

"There are too many single points of failure," he said. "The U.S. has one woven-glass manufacturer, two copper-foil manufacturers and just two companies in Silicon Valley making test boards that semiconductor manufacturers rely on. If you're going to reshore semiconductor production, you should reshore other elements of that supply chain. The defence business alone simply won't sustain our industry."

Today, some commercial off-the-shelf technology sourced in places that the U.S. wouldn't consider friendly is making its way into the defence, Schild told EE Times. The U.S. needs to strengthen ITAR (International Traffic in Arms Regulations) controls by having the Pentagon vouch for its supply chains and secure them, he added. "The NDAA [National Defence Authorization Act] calls upon them to do that, but it gives the government and industry from this point four years to accomplish that."

Schild argued that PCBs are used in more than just defence equipment that's critical for national security:

"What about the energy infrastructure? What about hospital infrastructure? What about banking and financial services? Critical infrastructure in the U.S. is broadly defined, and that critical infrastructure should rely on trusted microelectronics."

Hyperscaler companies like Amazon and Google run data centers using high-end PCBs made with 60-70 layers and multiple lamination cycles. It's the same type of board that's used by the military to take advantage of speed and signal integrity. PCB makers hope that, with the new U.S. incentives, the hyperscalers will source more of their boards in the U.S.

Circuit boards from renewable raw materials –

By Empa, Swiss Federal Laboratories for Materials Science and Technology

For many years, Thomas Geiger has been conducting research in the field of cellulose fibrils – fine fibres that can be produced from wood pulp or agricultural waste, for example. Cellulose fibrils hold great potential for sustainable production and the decarbonization of industry: they grow CO₂-neutral in nature, burn without residues and are even compostable. They can be used for many purposes, for example as fibre reinforcement in technical rubber products such as pump membranes.

But can cellulose fibrils perhaps also be used to make circuit boards that reduce the ecological footprint of computers? Printed circuit boards (PCBs) in particular are anything but innocent ecologically: They usually consist of glass fibres soaked in epoxy resin. Such a composite material is not recyclable and can so far only be disposed of properly in special pyrolysis plants.

Computer mouse with an ivory look

Geiger had already produced circuit boards from cellulose fibrils and investigated their biodegradation. Mixed with water, the bio-fibrils produce a

thick sludge that can be dewatered and compacted in a special press. Together with a colleague, he produced 20 experimental boards, which were subjected to various mechanical tests and finally fitted with electronic components. The test succeeded, and the cellulose board released the soldered-on components after a few weeks in natural soil.

Geiger had previously been involved in an Innosuisse project together with the OST University of Applied Sciences in Rapperswil, which produced housing parts for computer mice. The housing parts have a silky sheen and are similar in colour and feel to workpieces made of ivory. But no manufacturer could be found who wanted to adopt the method. The price competition for small electronics is still too great for this – and conventional plastic injection moulding processes have a clear advantage in this respect.

Circuit boards made of wood wool or cellulose fibres and fibrils

Recently, the opportunity arose to build on existing findings: Empa sustainability specialist Claudia Som was asked if she would like to collaborate on the EU research project Hypelignum. This is led by the Swedish materials research institute RISE and is looking for new ways of sustainably producing electronics. Claudia Som enlisted the help of her colleague Thomas Geiger.

The project started in October 2022, and the research consortium, with participants from Austria, Slovenia, Spain, the Netherlands, Sweden and Switzerland, plans to produce and evaluate eco circuit boards made of various materials: In addition to nanofibrillated cellulose (CNF), wood wool and wood pulp are being investigated as a base; wood veneer is also being used as a base for the circuit boards.

Two Empa labs are collaborating on the project: Firstly, the sustainability specialists led by Claudia Som from the Technology and Society lab. Som will use material databases to calculate the ecological footprint of the eco circuit boards and compare the individual concepts with each other. Thomas Geiger from Empa's Cellulose & Wood Materials laboratory will manufacture the circuit boards from renewable raw materials. Green electronics has long been a research focus of the lab, which is headed by Gustav Nyström; Nyström's team has already developed various printed electronic components from biodegradable materials, such as batteries and displays. The requirements for industrially produced computer circuit boards, however, are not trivial: Not only must the boards have high mechanical strength, they must also not swell in humid conditions or form cracks at very low humidity.

“Cellulose fibres can be a very good alternative to glass fibre composites,” Geiger explains. “We dewater the material in a special press with 150 tons of pressure. Then the cellulose fibrils stick together on their own without any

additives. We call this ‘hornification’.” The key here is at what pressure, temperature and for how long the pressing process must take place to produce optimal results.

Four demonstrators planned

The EU project Hypelignum has ambitious goals: It aims not only to study printed circuit boards made from renewable and compostable raw materials, but also to develop conductive inks for the electrical connections between individual components. These inks are often made based on silver nanoparticles. The researchers are looking for cheaper and less scarce substitute materials, as well as an ecological production method for these nanoparticles.

At the end of the project, four demonstrators ought to show what had been achieved: an ecologically exemplary printed circuit board, a large construction element made of wood that will be equipped with sensors and actuators, pieces of furniture that will be equipped with sensors in an automated production line, and finally a demonstrator that will prove the recyclability of all these components.

Infobox: Displays and batteries made from cellulose

In 2022, an Empa research group led by Gustav Nyström succeeded in building a biodegradable display based on hydroxypropyl cellulose (HPC). They used HPC as a substrate and added a small amount of carbon nanotubes, making the cellulose electrically conductive. By mixing in cellulose nanofibres (CNF), they brought the ink into a printable form. The display changes colour depending on the applied electrical voltage; in addition, it can also serve as a pressure or tension sensor and has the potential to play a role as a biodegradable user interface in future eco-electronics.

Duke University engineers have produced the world’s first fully recyclable printed electronics that replace the use of chemicals with water in the fabrication process

By eschewing the need for hazardous chemicals, the work points down a path industry could follow to reduce its environmental footprint.

April 24, 2023

Andrew Corselli

Tech Briefs

Duke University engineers have produced the world’s first fully recyclable printed electronics that replace the use of chemicals with water in the fabrication process. By eschewing the need for hazardous chemicals, the work,

which appeared in Nano Letters, points down a path industry could follow to reduce its environmental footprint and human health risks.

Electronics manufacturers are faced with the challenge of successfully securing several layers of components on top of each other — imperative to making complex devices. Getting the layers to stick is the tricky part, particularly for printed electronics.

“If you’re making a peanut butter and jelly sandwich, one layer on either slice of bread is easy,” said professor and study lead Aaron Franklin. “But if you put the jelly down first and then try to spread peanut butter on top of it, forget it, the jelly won’t stay put and will intermix with the peanut butter. Putting layers on top of each other is not as easy as putting them down on their own — but that’s what you have to do if you want to build electronic devices with printing.”

Previously, Franklin’s team demonstrated the first fully recyclable printed electronics. The devices used three carbon-based inks: semiconducting carbon nanotubes, conductive graphene, and insulating nanocellulose. In trying to adapt the original process to only use water, the carbon nanotubes presented the largest challenge.

To make a water-based ink in which the carbon nanotubes don’t clump together and spread evenly on a surface, a surfactant akin to detergent is added. The resulting ink, though, doesn’t create a layer of carbon nanotubes dense enough for a high current of electrons to travel across.

“You want the carbon nanotubes to look like al dente spaghetti strewn down on a flat surface,” said Franklin. “But with a water-based ink, they look more like they’ve been taken one-by-one and tossed on a wall to check for doneness. If we were using chemicals, we could just print multiple passes again and again until there were enough nanotubes. But water doesn’t work that way. We could do it 100 times and there’d still be the same density as the first time.”

Franklin and his team developed a cyclical process in which the device is rinsed with water, dried in relatively low heat, and printed on again. When the amount of surfactant used in the ink is also tuned down, the researchers show that their inks and processes can create fully functional, fully recyclable, fully water-based transistors.

Franklin explains that, by demonstrating a transistor first, he hopes to signal to the rest of the field that there is a viable path toward making some electronics manufacturing processes much more environmentally friendly. And while the process does use a lot of water, it’s not nearly as much as what is required to deal with the toxic chemicals used in traditional fabrication methods.

While more work remains, Franklin said the approach could be implemented in the manufacturing of other electronic components — e.g., the now-ubiquitous screens and displays.

“The performance of our thin-film transistors doesn’t match the best currently being manufactured, but they’re competitive enough to show the research community that we should all be doing more work to make these processes more environmentally friendly,” Franklin said.

Here is a Tech Briefs interview, edited for clarity and length, with Franklin.

Tech Briefs: What were some of the biggest technical challenges you faced throughout your work?

Franklin: Simply getting rid of the use of water may not seem that significant, especially since several of the inks we used were already water-based. The challenge is that any ink containing nanomaterials will have other additives included to functionalize the nanomaterials, keeping them from clumping together and ensuring they print into uniform films. Getting rid of these residual additives in the final printed films is not easily achieved, typically requiring more harsh solvents and high temperatures. The process we developed in this work uses only water and a maximum temperature of 70 °C — the lowest temperature to date for realizing fully printed thin-film transistors.

Tech Briefs: Can you explain in simple terms how the process works?

Franklin: We have been working for several years on developing printed recyclable electronics — where all materials can be reclaimed and reused. Throughout that work, we became increasingly aware of how reliant our processes were on hazardous chemicals, which have their own significant impact on the environment. Since some of the inks we used were water-based, we decided to try to develop a printed transistor process that used nothing but water. So, this process works by printing layers of semiconducting, conducting, and insulating nanomaterials to form the electronic switching devices known as transistors.

Tech Briefs: Do you have any set plans for further research/testing?

Franklin: To get closer to utility in applications, the performance of the transistors we demonstrated in this work needs to improve. What we have shown is the possibility, but now there is need for optimization. With further research into the space, I’m confident there will be more materials, processes, and ultimately applications made possible for recyclable, water-only printed electronics.

Tech Briefs: What are your next steps? Next goal(s)?

Franklin: The backplane electronics for displays are composed primarily of thin-film transistors (LTPS or LTPO) that rely on high greenhouse-gas-emitting manufacturing; if those transistors were able to be printed from a water-only process with recyclable materials it would be completely transformative. My group is continuing to seek research funding to pursue this path, with the next goal being demonstration of printed, water-only transistors that meet the performance targets for driving displays in the backplane.

Tech Briefs: Do you have any advice for engineers aiming to bring their ideas to fruition?

Franklin: Always be aware of discoveries you did not necessarily set out to make; it's often the unexpected findings that are the most impactful and able to carry ideas to fruition.

Tech Briefs: Is there anything else you'd like to add?

Franklin: We are just scratching the surface for exploring printed, recyclable electronics and hope to see a much greater effort fuelled by increased research funding in the years ahead.

NEWS FROM THE IPC

North American PCB Industry Sales Up 11.6 Percent in March *IPC releases PCB industry results for March 2023*

BANNOCKBURN, Ill., USA, April 27, 2023 — [IPC](#) announced today the March 2023 findings from its North American Printed Circuit Board (PCB) Statistical Program. The book-to-bill ratio stands at 0.91.

Total North American PCB shipments in March 2023 were up 11.6 percent compared to the same month last year. Compared to the preceding month, March shipments were up 30.1 percent.

PCB bookings in March were down 10.5 percent compared to the same month last year. March bookings were up 2.3 percent compared to the preceding month.

“The book-to-bill slipped this month, but this was driven in part by strong shipments,” said Shawn DuBravac, IPC chief economist. “Order flow is holding steady, but at lower levels than a year ago.”

Detailed Data Available

Companies that participate in IPC’s North American PCB Statistical Program have access to detailed findings on rigid PCB and flexible circuit sales and orders, including separate rigid and flex book-to-bill ratios, growth trends by product types and company size tiers, demand for prototypes, sales growth to military and medical markets, and other timely data.

Interpreting the Data

The book-to-bill ratios are calculated by dividing the value of orders booked over the past three months by the value of sales billed during the same period from companies in IPC’s survey sample. A ratio of more than 1.00 suggests that current demand is ahead of supply, which is a positive indicator for sales growth over the next three to twelve months. A ratio of less than 1.00 indicates the reverse.

Year-on-year and year-to-date growth rates provide the most meaningful view of industry growth. Month-to-month comparisons should be made with caution as they reflect seasonal effects and short-term volatility. Because bookings tend to be more volatile than shipments, changes in the book-to-bill ratios from month to month might not be significant unless a trend of more than three consecutive months is apparent. It is also important to consider changes in both bookings and shipments to understand what is driving changes in the book-to-bill ratio.

IPC's monthly PCB industry statistics are based on data provided by a representative sample of both rigid PCB and flexible circuit manufacturers selling in the USA and Canada. IPC publishes the PCB book-to-bill ratio by the end of each month.

North American EMS Industry Down 3.1 Percent in March *IPC releases EMS industry results for March 2023*

BANNOCKBURN, Ill., USA, April 27, 2023—[IPC](#) announced today the March 2023 findings from its North American Electronics Manufacturing Services (EMS) Statistical Program. The book-to-bill ratio stands at 1.28.

Total North American EMS shipments in March 2023 were down 3.1 percent compared to the same month last year. Compared to the preceding month, March shipments increased 6.2 percent.

EMS bookings in March decreased 7.1 percent year-over-year and increased 9.9 percent from the previous month.

"The pattern that emerged in Fall 2022 continued into March. EMS shipments continue to show strength as supply chain challenges dissipate but order flow remains weak," said Shawn DuBravac, IPC chief economist.

Detailed Data Available

Companies that participate in IPC's North American EMS Statistical Program have access to detailed findings on EMS sales growth by type of production and company size tier, order growth and backlogs by company size tier, vertical market growth, the EMS book-to-bill ratio, 3-month and 12-month sales outlooks, and other timely data.

Interpreting the Data

The book-to-bill ratios are calculated by dividing the value of orders booked over the past three months by the value of sales billed during the same period from companies in IPC's survey sample. A ratio of more than 1.00 suggests that current demand is ahead of supply, which is a positive indicator for sales growth over the next three to twelve months. A ratio of less than 1.00 indicates the reverse.

Year-on-year and year-to-date growth rates provide the most meaningful view of industry growth. Month-to-month comparisons should be made with caution as they reflect seasonal effects and short-term volatility. Because bookings tend to be more volatile than shipments, changes in the book-to-bill ratios from month to month might not be significant unless a trend of more than three consecutive months is apparent. It is also important to consider changes in both bookings and shipments to understand what is driving changes in the book-to-bill ratio.

IPC's monthly EMS industry statistics are based on data provided by a representative sample of assembly equipment manufacturers selling in the USA and Canada. IPC publishes the EMS book-to-bill ratio by the end of each month.

European Chips Act Crosses the Finish Line as IPC Looks to the Future

By Sandy Gentry

By Alison James, senior director, European government relations

IPC

This week, the European Institutions reached provisional agreement on the European Chips Act, paving the way for the region's introduction of an important framework to build out innovation in the European semiconductor ecosystem and security of supply for Europe's industries.

The European Chips Act, proposed by the European Commission in February 2022, has been the subject of negotiation with the European Parliament and the EU Council (Member States). While this week's agreement must still be finalized, endorsed and formally adopted by both institutions, it sets the wheels in motion for the roll-out of Europe's own Chips Act. Formally, following adoption, the EU Council will pass an amendment for the establishment of the Chips Joint Undertaking under Horizon Europe. Both legal texts will be published at that time.

IPC welcomes the European Chips Act as an important step towards strengthening European leadership in innovation and secure and resilient supply chains. In the negotiation process, IPC strongly welcomed fresh emphasis brought by the European Parliament to strengthening European semiconductor packaging capability and enabling a more robust electronics ecosystem. Throughout the process, IPC has urged the adoption of a final package that reflects the strategic role of advanced packaging in driving semiconductor innovation and ensures needed funding is allocated accordingly (see our position on the initial draft legislation).

In an executive meeting with European Government officials organized by IPC and iMAPS on April 13th, industry leaders welcomed the imminent adoption of the Chips Act and its inclusion of packaging in scope. They discussed next steps needed to enable European leadership in back-end segments of the value chain, including IC substrate fabrication and semiconductor assembly & test. The meeting also included leading European EMS and Printed Circuit Board companies that underscored the next steps needed to support a more resilient European electronics manufacturing ecosystem “silicon-to-systems.”

A silicon-to-system strategy would enhance the region’s capabilities and capacities to package semiconductors into advanced components but also include the assembly of those components onto printed circuit boards. This entire silicon to systems ecosystem is necessary to support Europe’s digital and green transitions.

IPC applauds the dedicated work of the European institutions in their negotiation process on the Chips Act. We remain committed to working with the EU Institutions, the industry and other key stakeholders in the Chips Act implementation, as well as the region’s broader initiatives to realign industrial policies to address vital vulnerabilities and ensure a more competitive, resilient and sustainable electronics industry.

For more information on the European Chips Act and Industrial Strategy, contact me at AlisonJames@ipc.org.

IPC Issues Call for Participation for High Reliability Forum

IPC is now accepting abstracts for the High Reliability Forum, the international conference focusing on Class 3 and safety critical electronics for mil-aero, automotive, medical, and long-life applications that are subjected to harsh use environments. The High Reliability Forum will be held October 17-19, 2023, at the Hilton Baltimore BWI Airport in Linthicum (Baltimore), Md.

IPC invites innovators and technologists to submit an abstract for a technical presentation during the conference. The IPC High Reliability Technical Forum Program Committee seeks proposals for technical presentations on the following topics:

- **High Reliable Materials:** PCB Fabrication Materials, Interconnecting, Bonding, Thermal/Power Management, Conductivity/Resistivity, Use Conditions/Environment (A&D vs. Automotive vs. Medical/Implantable vs. High Perf Computing, etc.), Environmental Restrictions/Impact, Substrates for Advanced Packaging
- **Design and Fabrication for High Reliability:** Materials Compatibility, Flexible Printed Boards in RF/Microwave Applications, Design for Reliability/Determining Reliability Requirements, System of Systems Architecture, Levels of Redundancy, HDI/Microvia Reliability -- Test Methods and Design Rules, Micro HDI and Substrate Technologies, First Level Interconnect Methodologies; Use of Simulation in the Design Process, Automotive/High Voltage Applications
- **Assembly for High Reliability:** Next Generation Solder Alloys, Solder Paste and Coating Selection for High Reliability, Reliability of Cleaning, Testing and Coating Strategies, Assembly Materials -- Coating, Cleaning, Underfilling, Encapsulation, Effects of No-Clean Residues, Voiding in Solder Joints, 3D Package Level Reliability, Assembly for Automotive/High Voltage Applications
- **Testing for High Reliability:** Fatigue Behavior and Reliability Testing for Solder Joints using Next Generation Solder Alloys, Harsh Environment Reliability and Testing, Thermal Stress Test Methods, Connector Failure Modes and Reliability, Vibration and Shock Test Methods for Predicting Reliability, HDI/Microvia Reliability, Automotive/High Voltage Applications, Heterogeneous Integration/Advanced Packaging for High Reliability

- **Issues around Quality, Standards for High Reliability:** Supply Chain, Reshoring/Onshoring, Failure Modes Effects Analysis (FMEA), Reliability Assurance and Prediction Workflows, Selection of Appropriate Class of Electronics, Requirements for Specific Class of Electronics, Manufacturing Standards, Emerging Electronic Technologies

“We are thrilled to welcome attendees back to the first High Reliability Forum since 2019,” said David Bergman, IPC vice president of standards and technology. “We are eager to see the exciting new work from experts in all areas of the industry including PCB design, fabrication materials, emerging technologies, and other applications with specialized reliability requirements.”

Abstracts summarizing original and previously unpublished work must be submitted for consideration to present. Presentations should be non-commercial and describe significant results from experiments, emphasize new techniques, discuss trends of interest, and contain technical and/or appropriate test results.

Abstracts are due on Monday, June 5, 2023 and will be peer-reviewed by the Technical Program Committee. Accepted abstracts will be invited to deliver a podium presentation in person at the High Reliability Forum in Linthicum Heights, Maryland, October 17-19, 2023.

For more information or to submit an abstract, visit www.ipc.org/event/high-reliability-forum. For questions regarding general event information, contact Julia Gumminger, IPC professional development and events manager, at JuliaGumminger@ipc.org.

For exhibit and sponsorship opportunities, contact Alicia Balonek, senior director, trade shows and events, at AliciaBalonek@ipc.org.

[NEWS FROM THE TPCA](#)

Apple’s PCB supply chain investment in Thailand increased again and prospered about 11.<> billion yuan to obtain land for factory construction

TPCA

Apple’s PCB supply chain has successively finalized the investment and construction of factories in Thailand, following Taihong and Huatong, Xinxing

announced today (21) that the Thai subsidiary obtained about 7,017 square meters of factory land in Bukhyau Province, with a total amount equivalent to about NT\$10.97 billion.

This is another new move of Apple's PCB supply chain to invest in Southeast Asia after Taihong Thailand factory has broken ground, Huatong has actively set up a Thai subsidiary and is scheduled to negotiate the follow-up purchase of land of about 11,640 pyeong for 9,85.5 million baht (NT\$4 million). It also shows that the southbound investment pause button pressed by Taiwan's PCB industry due to the epidemic has been lifted, and will accelerate action in line with customer demand.

In the Apple supply chain, Jianding crossed into Southeast Asia to take a unique step, and Jianding completed the acquisition of a Japanese PCB factory in Dong Nai Province, Vietnam at a symbolic price of 1 US dollar, completed the transfer of equity, and is expected to invest in the production of products including server boards after improving the manufacturing process, which is also the first time that Jianding with a monthly PCB production capacity of 1 million square feet has stepped out of the cross-strait layout.

Jianding has many years of experience in the execution of investment projects in Southeast Asia, this time for 1 US dollar acquisition of a Japanese PCB factory located in Bien Hoa Industrial Zone, Dong Nai Province, Vietnam, has completed the official equity transfer process, and the mainland Wuxi factory deputy general manager Lu Zhengming as the person in charge, is expected to invest another 2-1000 million yuan to improve the process, when it can be put into the production of multi-layer board products including server boards.

Jianding this time to acquire the equity of South Vietnam's existing Japanese PCB factory by way of acquisition, and immediately obtain the existing production capacity, mainly in response to the client's demand for the establishment of diversified production capacity outside the strait, only the purchase and acquisition of the existing production capacity of the South Vietnamese Japanese PCB factory is not large, about 1,2 employees, is the production of low-end automotive steel and consumer electronics boards, after Jianding takes over, it is estimated that the maximum monthly revenue contribution is <> million to <> million yuan.

In addition, Apple's supply chain has set up an SMT factory in India, but has not yet made the latest decision on PCB investment outside the strait. (News source: Juheng.com)

[NEWS FROM THE CPCA](#)

China Printed Circuit Association (CPCA) aims to make Thailand its new electronic equipment manufacturing base in a move to avoid the impact of the China-US trade war and geopolitical conflicts

April 26, 2023

Bangkok Post

The China Printed Circuit Association (CPCA) aims to make Thailand its new electronic equipment manufacturing base in a move to avoid the impact of the China-US trade war and geopolitical conflicts, says the Board of Investment (BoI).

"China is seeking new investment and production destinations, following worries over the trade war and increasing tension between China and Taiwan, which are considered business risks," said Narit Therdsteerasukdi, secretary-general of the BoI.

"Thailand is attractive to Chinese investors."

Chinese businesspeople believe Thailand has the potential to become the electronics hub of Asean because the government is promoting investments in targeted industries, notably electric vehicles and smart electronics, said Mr Narit.

Representatives of more than 60 companies under the CPCA met the BoI between April 19-22 to discuss investment prospects and incentives in the country.

Two companies - ASKPCB and WUS Printed Circuit (Kunshan) - are planning to invest in Thailand, with a total investment value of around 12 billion baht, according to the BoI.

They will also bring 200 suppliers in the electronics supply chain to Thailand.

At present, the CPCA has 800 members, including manufacturers of printed circuit boards (PCBs) and special electronics equipment, as well as experts from academic and research institutes.

The electronic and PCB industry in China has a market value of over 1.7 trillion baht and employs up to 620,000 workers.

The BoI approved 18 investment project proposals in the electronics and PCB industry between 2018 and 2022. The investment value of these projects was 39 billion baht in total.

During the first quarter of this year, five additional investment projects in the electronics and PCB industry, with a value of 14 billion baht, were endorsed by the BoI.

Mr Narit said the BoI would continue to encourage more PCB manufacturers to invest in Thailand. The BoI plans to meet 30 PCB companies from Hong Kong in June and 10 PCB companies from Taiwan in July. Thailand needs PCBs and electronic equipment as the country is promoting EVs and digital technology.

In 2021, the National EV Policy Committee said it wanted EVs to constitute 50% of locally made vehicles by 2030, part of a plan to make Thailand a regional EV production centre.

Last year, the cabinet approved a package of incentives, including tax cuts and subsidies, to promote EV consumption and production between 2022 and 2023.

According to officials, a plan to build a 5-billion-baht Silicon Tech Park, expected to be a model for Thai digital cities, is set to start this year in the Eastern Economic Corridor (EEC).

The project, dubbed the “Silicon Valley of the East” and co-developed by Planet Communications Asia Plc, Cisco and the EEC Office, is located in an area spanning 500-700 rai in Rayong’s Ban Chang district.

The BoI is implementing a five-year investment promotion strategy, which starts in 2023, to support investments in high technology, green and smart industries, as well as businesses driven by creativity and innovation. Provided by SyndiGate Media Inc. (Syndigate.info).



The European Institute for the PCB Community

EIPC SPEeDNEWS

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International Diary

2023

21st EIPC Technical Snapshot Webinar

3 May

Registrations via www.eipc.org

EIPC @ SMT-connect

9-11 May

Nuremberg, Germany

EIPC Summer Conference

Visit BMW World

15 & 16 June

Munich, Germany

22nd EIPC Technical Snapshot Webinar

Registrations via www.eipc.org

September

23rd EIPC Technical Snapshot Webinar

Registrations via www.eipc.org

October

EIPC @ Productronica 2023

14-17 November

München, Germany

24th EIPC Technical Snapshot Webinar

Registrations via www.eipc.org

December