Tue, 3 December 2024
Weekly Newsletter

DVN
Lighting

NEWSLETTER #882

Editorial

2024 DVN Study Goes Live

We have just published our 2024 DVN Study; starting today, you can get it on the DVN website. The subject: ISD, Interactive Social (or Signalling) Displays. Last year we decided to cover this new technology coming mainly from China and new EV makers, like Human Horizon, Avatr, and IM Motors. What technologies are deployed, for what purposes; what are the regulatory limitations, what are the costs and estimated take rates in five years?

To build the study, DVN senior experts collected a great deal of information from a variety of channels, including a lot of events—CES, Beijing Autoshow, ALE, ISAL,

VISION, and of course our own DVN workshops—and interviews with important automakers, set makers, light source tier-2s, and universities.

A lot of new agents are joining the game, especially from the display world, with new LED ICs and technology and smaller packages. MiniLED technology seems to be the preferred technology for monocolour and RGB applications. There are more and more vehicles with ISD, and more and more participants in the resultant ecosystem, driving more and more volumes, driving down costs. These developments seem to be right on time; the first miniLED applications were seen for exterior displays about 10 years ago, if I recall correctly.

Last week I saw new applications from generalist automakers GAC, Mahindra and Nissan, which confirms that ISD and exterior displays are not limited to new EV makers and are expanding to markets beyond China. Differentiation of this nature, and the possibility to communicate with other road users, are growing more and more important.

The DVN Shanghai event starts tomorrow with a dedicated session about ISD and miniLEDs, including 16 really interesting lectures. This is one of main hot topics right now for the vehicle lighting supply chain, and the DVN team is hard at work covering it for you!

Paul-Henri Matha
DVN Chief Executive Officer and Lighting General Editor

In Depth Lighting Technology

DVN @ TechBlick '24 in Berlin

By Paul-Henri Matha

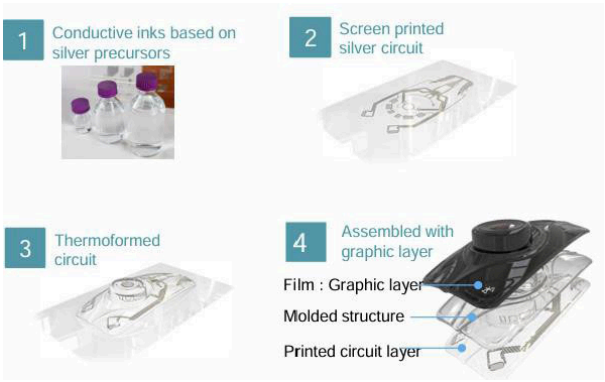
It was a pleasure to be invited by Dr. Khasha Ghaffarzadeh to give a lecture at Techblick, explaining our DVN vision on smart surfaces for automotive interiors. Techblick gathered more than 650 experts on flexible, additive manufacturing of electronics, printed electronics, and related fields from all business areas—"GAFA" (Google, Apple, Facebook Amazon), aerospace, military, healthcare, research institute, university and automotive sectors—to share their research.

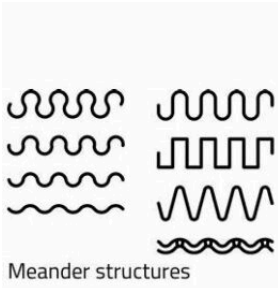
The automotive sector is a relatively tiny speck in this business, but the quantity of innovations, especially for sustainable, wearable, invisible, stretchable electronics is quite impressive and for sure this technology will proliferate in cars sooner or later, pushed strongly by the consumer/influencer sphere, GAFA, and the military.

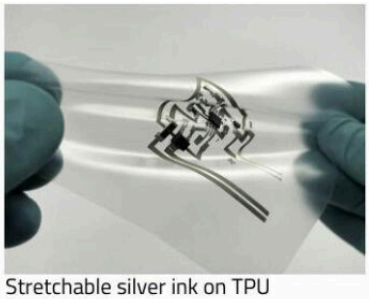
Here's my take on some of these forthcoming technical concepts that may apply for our automotive business. This is not an exhaustive report, which would need too much time and better expertise; me, I am just a lighting engineer!

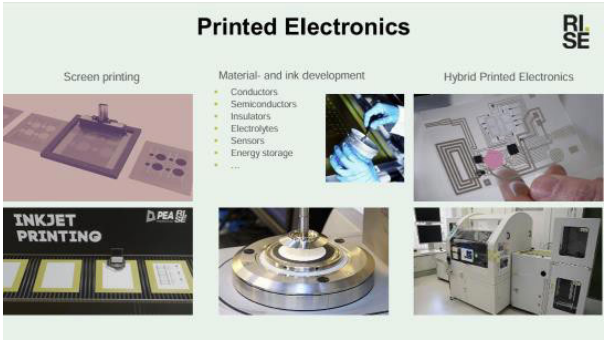
What's this all about?

Flexible PCBs, films, and printed electronics with conductive ink involving the likes of silver or carbon.

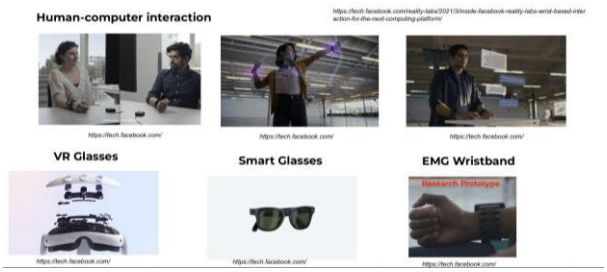


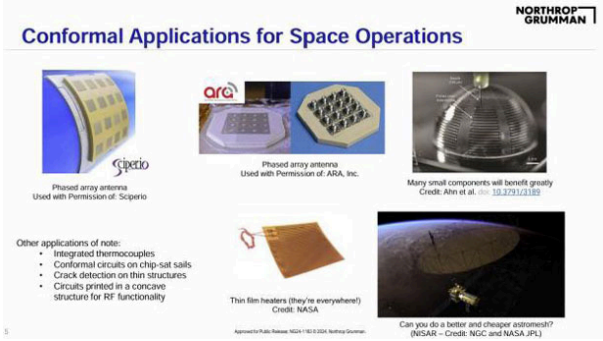






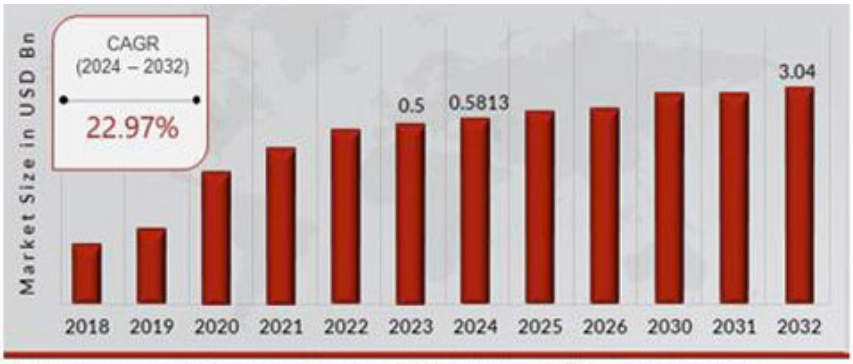
Possible military and aerospace applications





Stretchable electronics

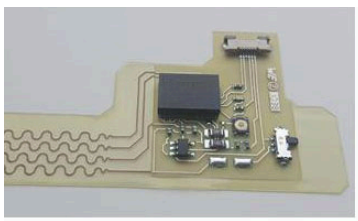
The market for stretchable electronics is likely to grow during the next 10 years, with applications in sensor technology, healthcare, 'smart' textiles, soft robotics, communications, energy, and cars.



Compound Annual Growth Rate of stretchable Electronics (2024-2034)

Source: MRFR Database, and Analyst

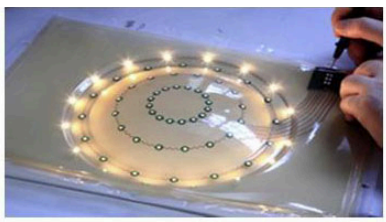
This includes stretchable printed circuit boards, with thermoplastic polyurethane (TPU) as a new copper-clad substrate material, with the tracks designed in meander form to realize the stretchability. It uses established manufacturing processes, and offers further processing options including thermoforming/deep drawing, back injection moulding, laminating, and more.



Assembly with SnBi-solder paste

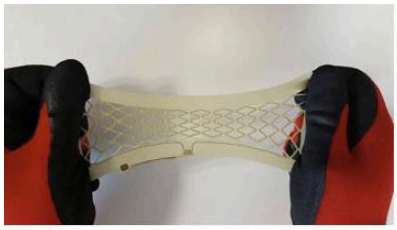
Laminated on textiles

Source: Fraunhofer IZM

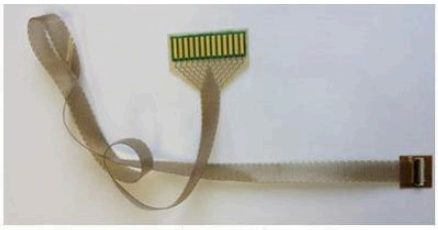


Example „Conformable Electronics“

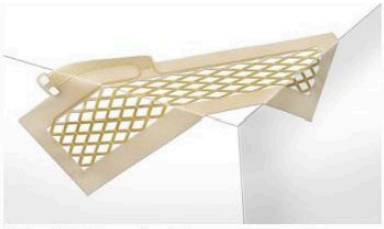
Source: Fraunhofer IZM



Dynamic stretch



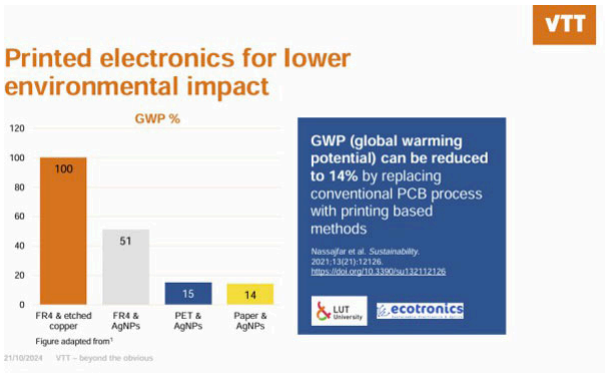
Multiple rotation (n x 180°)

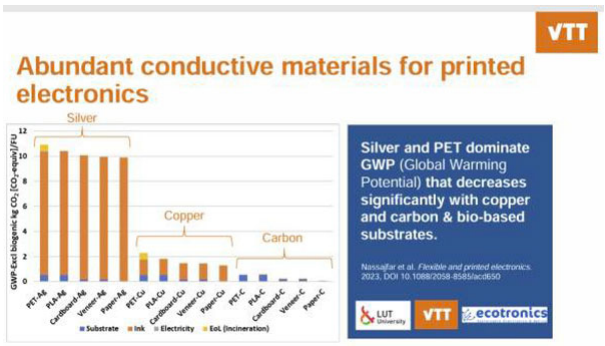


Adaptable material

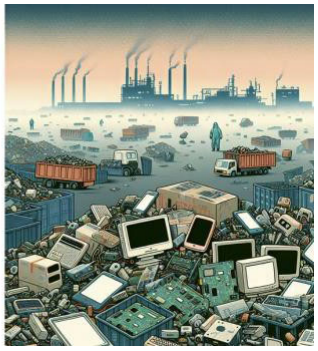
Replacement of classical FR4 PCB to reduce CO_2

Finnish research institute **VTT** mentioned that global warming potential (GWP) can be slashed by 86 per cent, by replacing conventional PCB processes with printing-based methods. Similarly, usage of copper or carbon bio-based substrates for conductive material can dramatically reduce the CO_2 footprint.

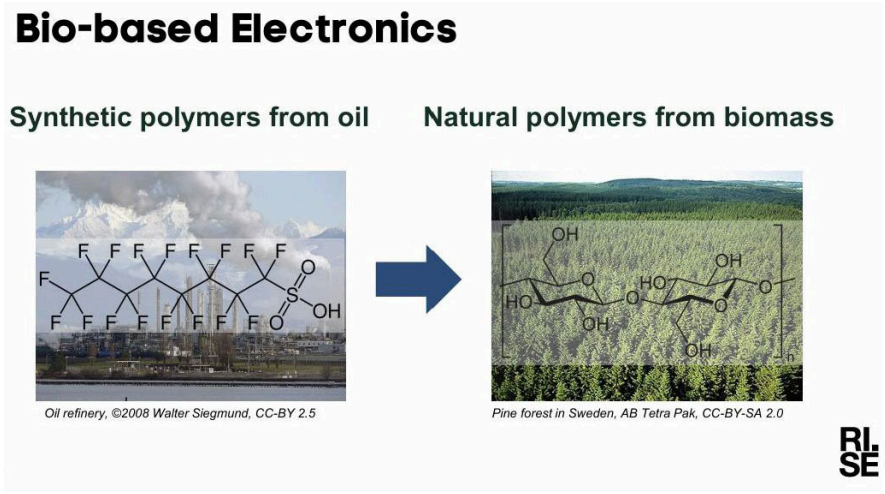


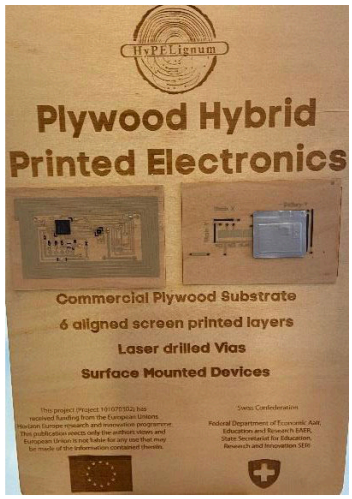


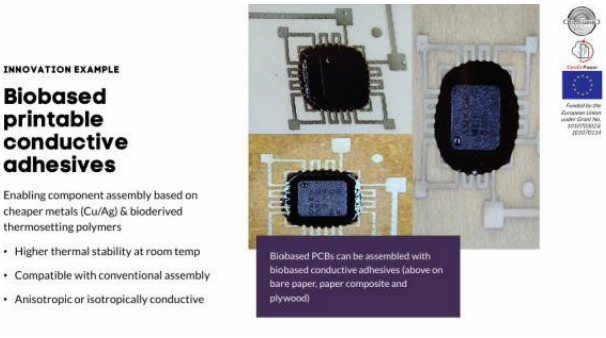
Swedish research institute **RI.SE** described how electronic waste ("e-waste") is increasing from 53.6 million tons in 2019 to 75 million tons by 2030. And only 17 per cent is collected for recycling; the total lost value in 2019 is estimated at $57bn. And because of this lack of recycling, hazardous materials like mercury, lead, cadmium, chromium, and PFAS are released into the environment in massive quantities.

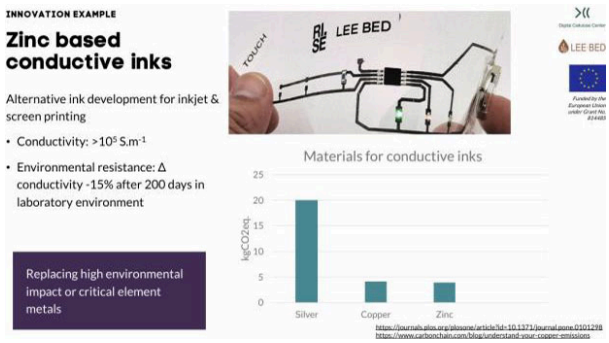


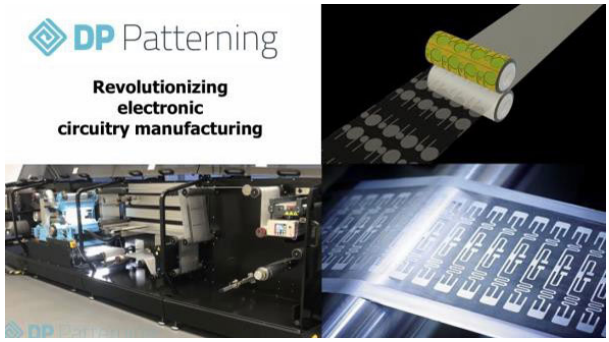
With printed electronics and especially bio-based electronics, we can tackle this problem. Solutions are ready for application.





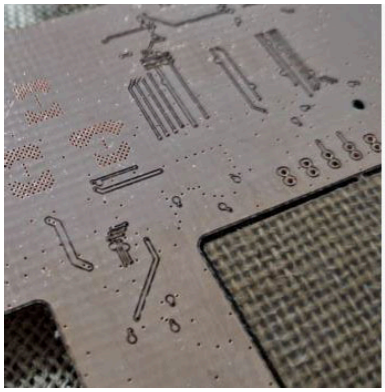


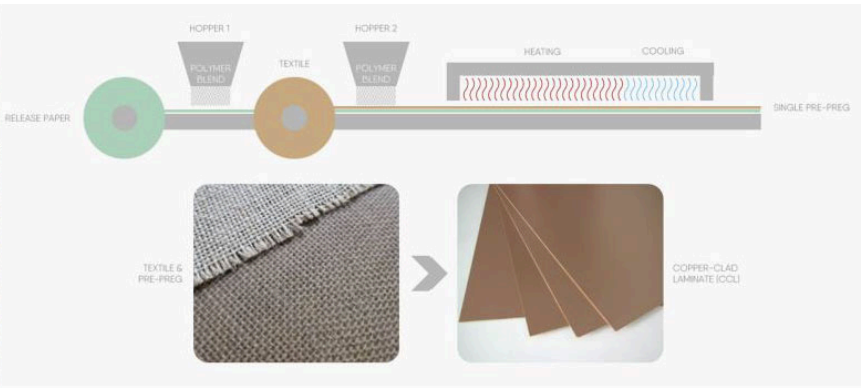


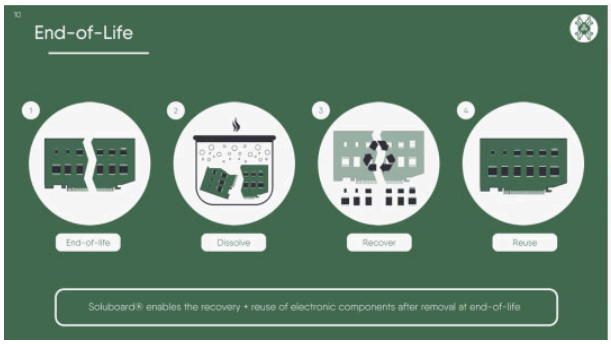


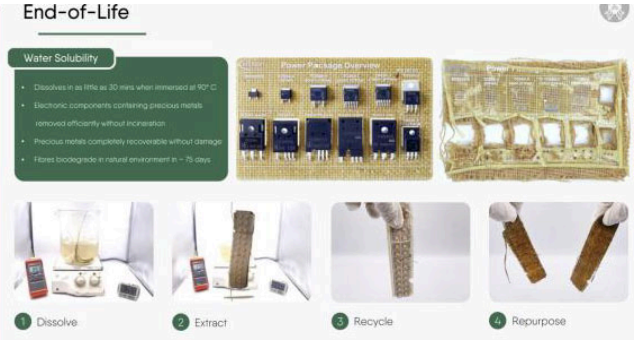
JIVA Materials showed that currently, between 40 and 60 per cent of panels become PCB waste, amounting to some €10bn. PCBs represent 42 per cent of global e-waste.

Then they presented their solution, called Soluboard: PCBs made out of natural fibres, with 67 per cent lower emissions versus FR4, and easy to recycle and re-use.



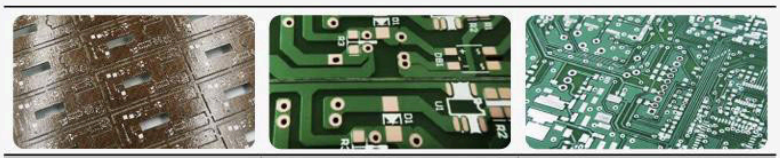






Thermal conductivity, always the main drawback with this sort of technology, has been compared and is showing good results, with performance between a CEM and FR4 PCB—a good fit for a low-power LED panel with 0.1W LED, for example.

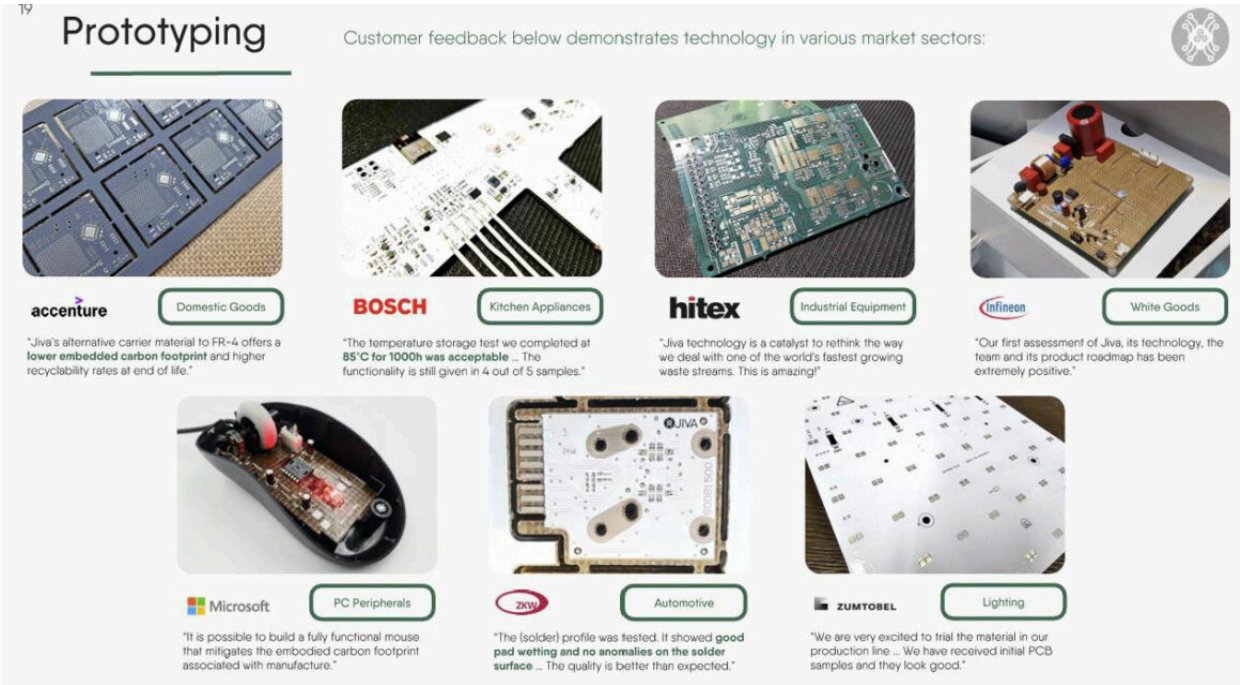
Incumbents



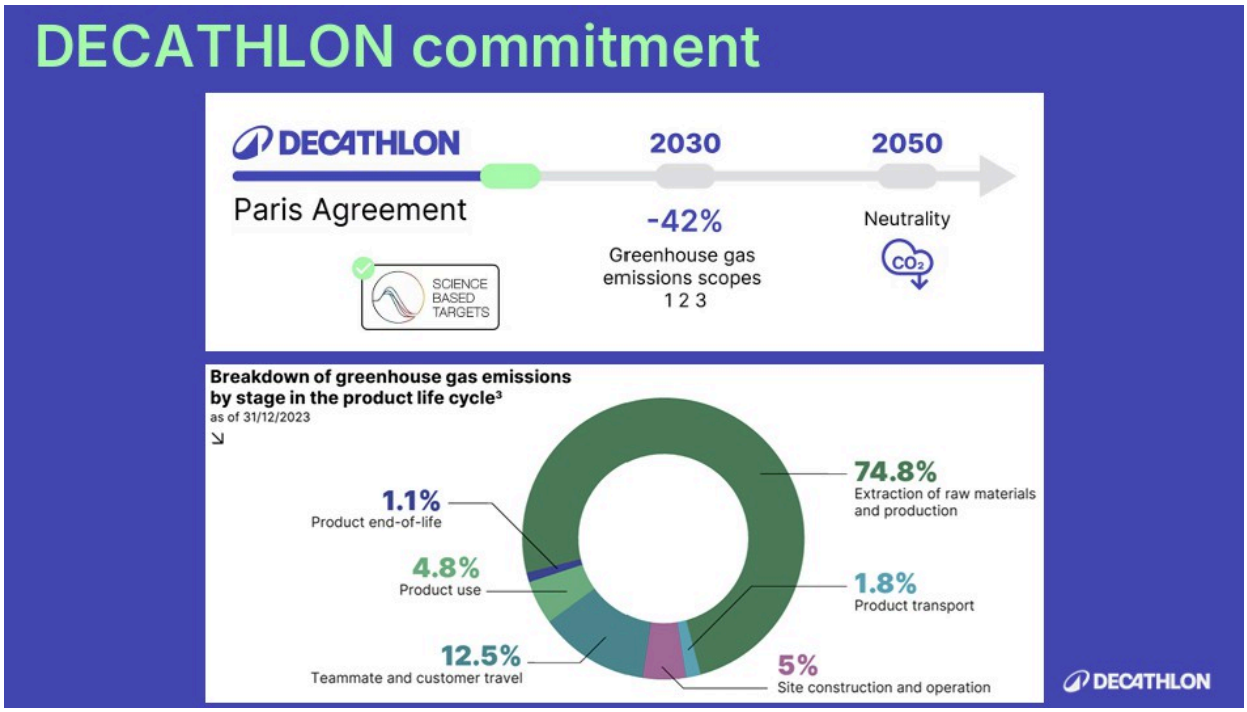
	Soluboard®	CEM-1	FR-4
Flammability Rating	UL94 V1	UL94 V0	UL94 V0
Comparative Tracking Index	PLC 0 (600V)	PLC 0 (600V)	PLC 0 (600V)
Permittivity @ 1 GHz	4.13	4.4	4.0 – 4.2
Thermal Conductivity (W/mk)	0.25	0.23	0.28
Soldering Temperature (°C)	170	270	270
Density (g/cm³)	1.35	1.60	2.00
Carbon Footprint (kg/m²)	5.52	13.55	16.94
Recyclable	✓	✗	✗
Bromine Free	✓	✗	✗

- Unlike Soluboard®, FR-4/CEM-1 contain brominated flame retardants i.e. biocides in the natural environment.
- Customers ready to pay 10 – 15% premium due to strict EU e-waste legislation + carbon footprint savings.

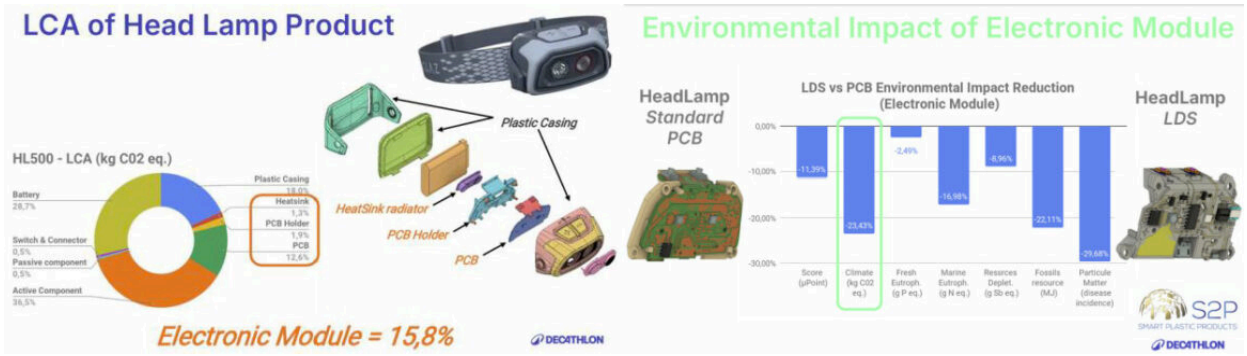
Prototypes are available and have been tested by customers like ZKW for lamp applications.



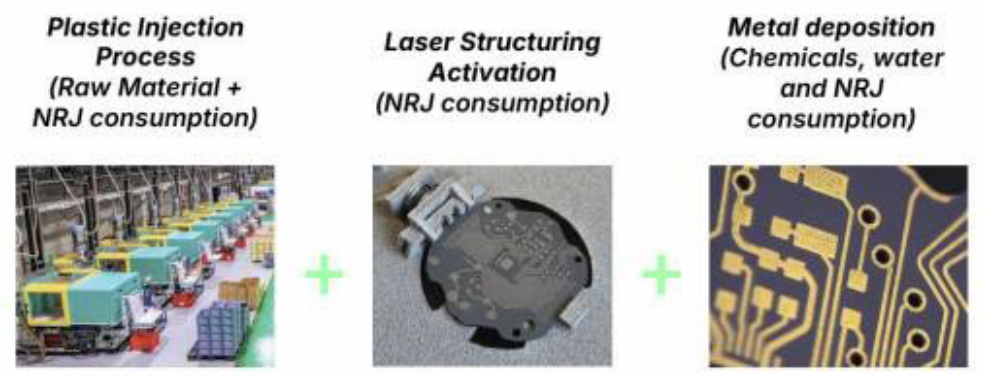
Another example of CO_2 footprint reduction was presented by **Decathlon**, a well-known outdoor and sport article company in France. They are investigating how to redesign their production to meet their carbon footprint target with CO_2 neutrality in 2050. Production is the main factor in their CO_2 footprint—75 per cent.



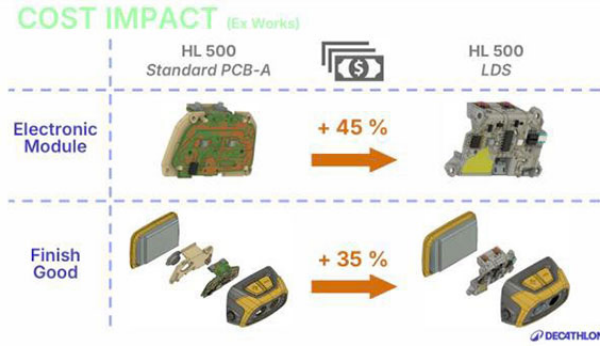
They selected as example of their LED outdoor lamp to see how printed electronics can reduce their CO_2 footprint. Electronic modules account for 15 per cent of their CO_2 emissions, according to their LCA (lifecycle assessment). By replacing PCBs with printed electronics, they can cut down on CO_2 emissions by 20 per cent for electronic modules, and 80 per cent of the PCB material itself.

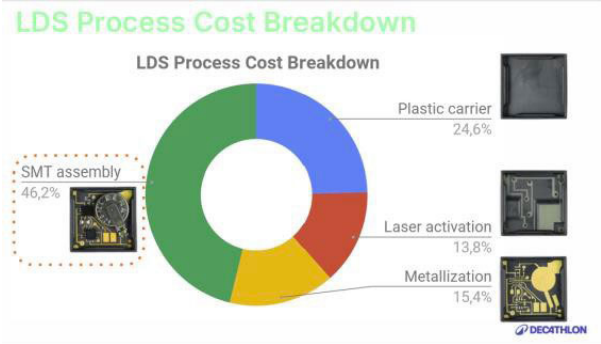


With iterative research and development, they've achieved very similar thermal conductivity. It's not quite identical; the LED case temperature is up by 5 Celsius degrees, but that is judged acceptable in the application.



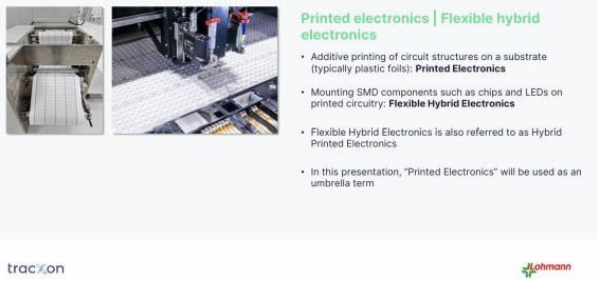
This electronic module modification raises the final-product cost by 35 per cent (SMT cost + metallization + laser ablation).

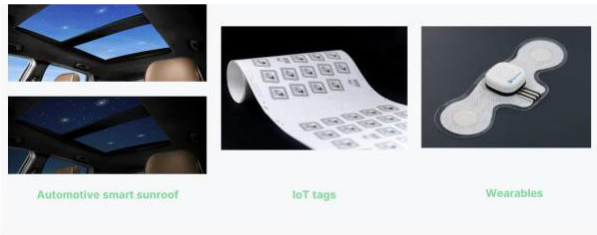




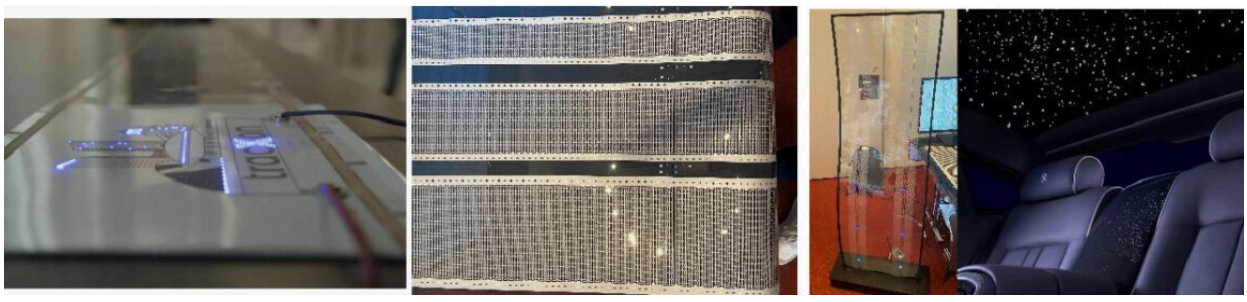
Large printed electronics

Tracxon presented additive printing on plastic foils with an SMD LED process.



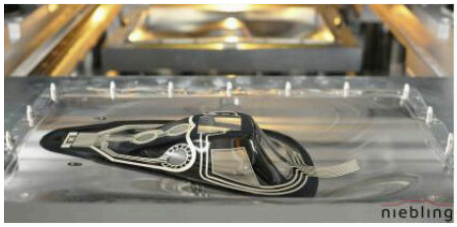


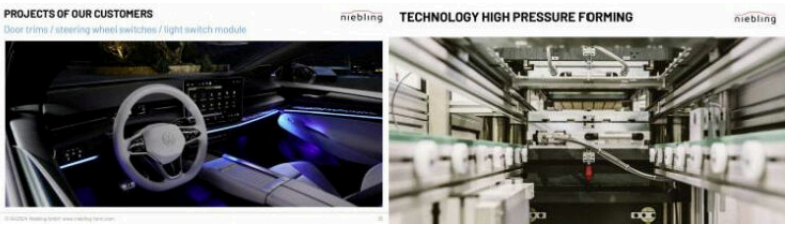
Automotive applications include sunroofs and headliners, with a fast (10 metres per minute), high-volume capacity. It's easy to foresee, for example, an application to replace the Rolls Royce headliner with a simple film compared to the current solution with multiple hardwires and flex boards.



In-shape film

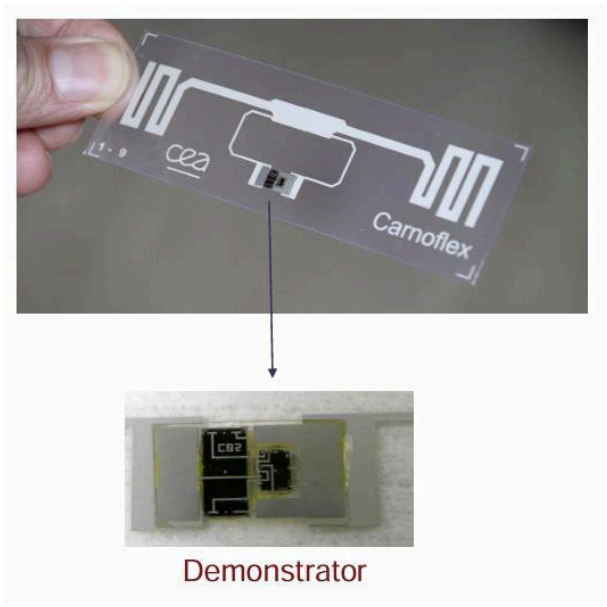
Niebling showed their technology to obtain a 3D shape from a 2D film. Film and ink elasticity properties permit to change the film shape without losing any electrical contact.

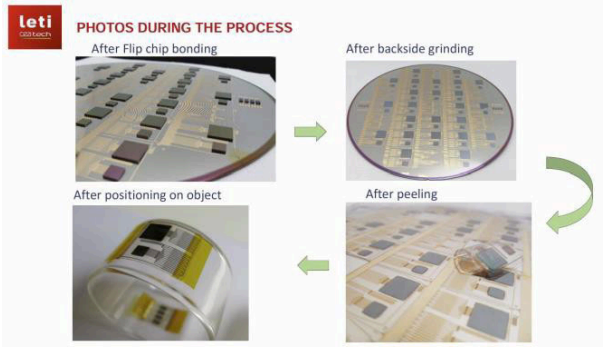




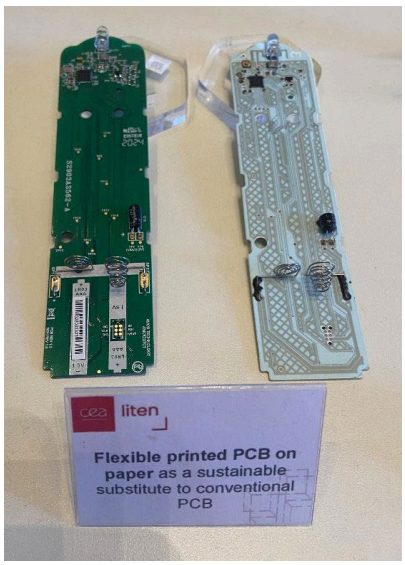
Integrated circuit for flexible PCB

French research institute **CEA Leti** presented their semiconductor IC that can be integrated on film without any SMD process.



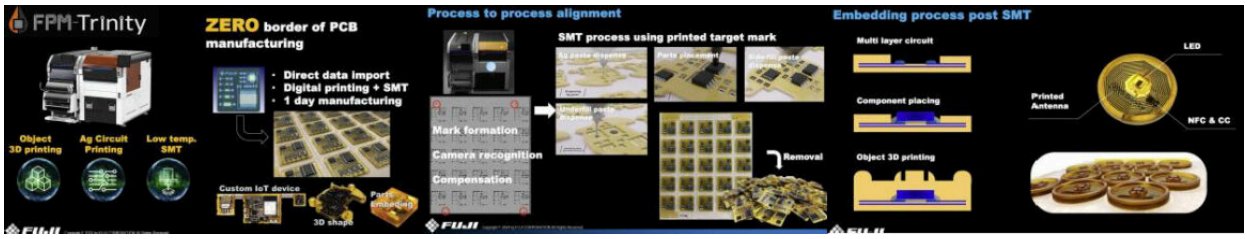


CEA Liten, another department of CEA, also showed their flexible PCB printed on paper.



3D Printed Electronics

Fuji presented possibilities to replace PCBs by additive manufacturing (3D printing) + ink deposit + SMD process.



Capillary Printing for Display Repair

French startup Hummink showed their High Precision Capillary Printing (HPCaP) not only as a high resolution and precision printing technology, but also as a solution that minimizes material usage and actively promotes sustainability through its repair capabilities. It is inspired by atomic force microscopy (AFM), and relies solely on capillary forces for printing on substrates.

Using a macro-resonator and state-of-the-art electronics, HPCAaP achieves precise control over printing parameters, allowing adjustments in print geometry such as thickness and line width, reaching sub-micron resolutions. With a glass pipette attached to the macro-resonator, HPCaP ensures real-time interaction between the substrate and the pipette, enabling high-quality dispensing. It ensures precise and continuous ink printing with no splashes or satellite drops, and eliminates waste by using up all the materials in the pipette. HPCaP can accommodate inks in tens of microliters to produce extensive samples with minimal ink volumes. It also exhibits impressive material and substrate versatility, being able to print on recyclable substrates like paper. Remanufacturing and repair have become vital for sustainability across industries, to extend the lifespan of electronic devices, displays, semiconductors, and automotive components by preserving and reusing materials. HPCaP technology enhances repair processes in various sectors, including displays, electronics, semiconductors, and automotive. For instance, in the semiconductor industry, HPCAP addresses challenges in repairing metallization defects at the micron scale, surpassing conventional methods.

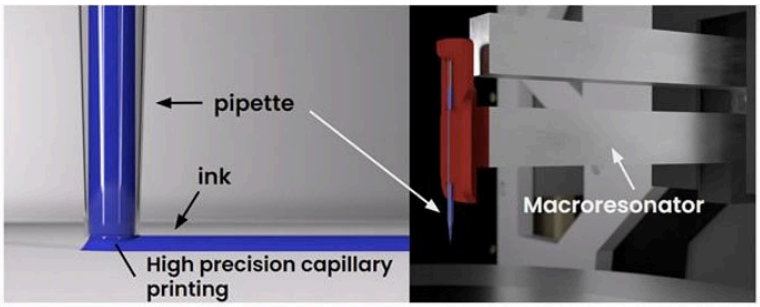


Figure 1. Illustration of HPCAP's Working Principle. .

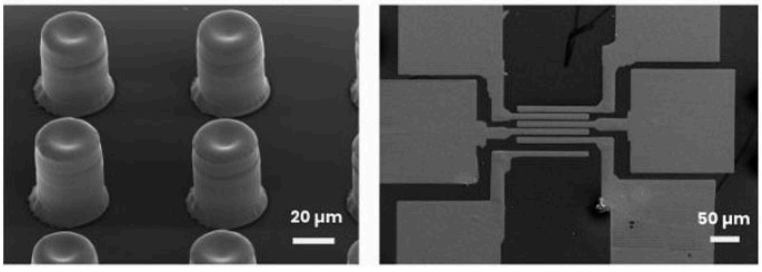
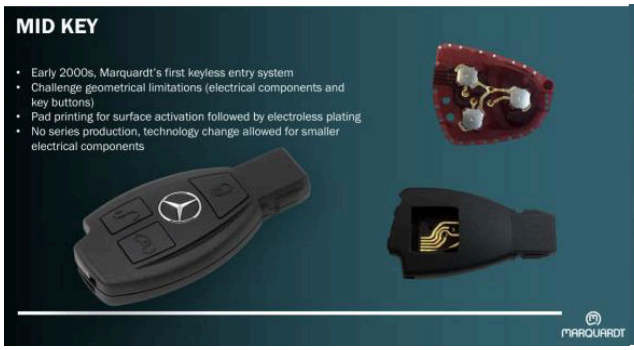
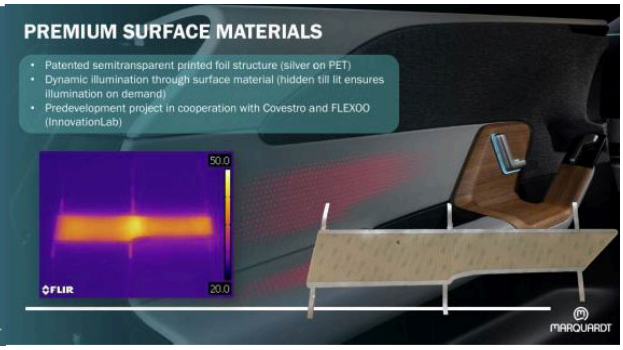


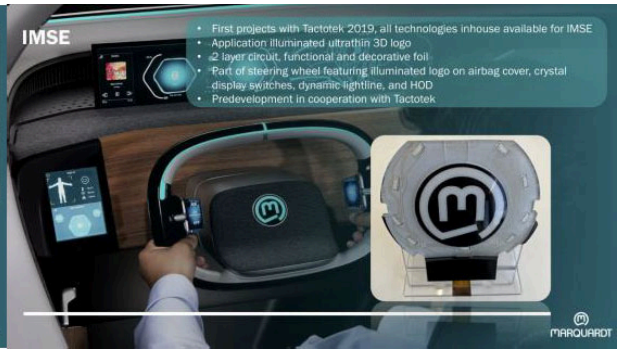
Figure 2: Bumps and Pads Printed by HPCAP.

Automotive Applications

Marquardt demonstrated their printed-electronics development, begun in the early '00s, with a keyless entry system. Similar technology is now used for diverse application like lit surface materials in door panels, and 'smart' surfaces including touch sensors and in-mould electronics.



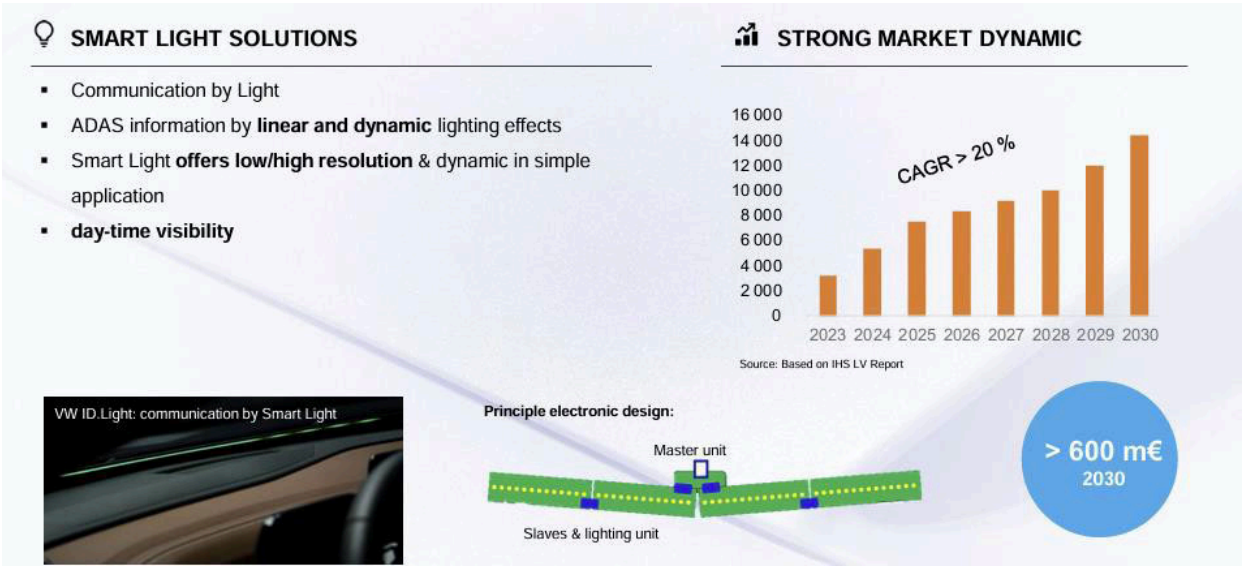




Marquardt described some pros and cons of this technology—challenges like proven and cheap classic electronics or processes not being ready for this technology; opportunities like fast growing technology and supplier base, new form factors and integrations possible, sustainability through material and process savings, and possibility to increase value creation.

Forvia shared their views about 'smart' surfaces and printed electronics for interior application: lighting, heating and sensing.

'Smart' lighting has a strong market dynamic with CAGR above 20 per cent by 2030.



However, similar pros and cons can be seen:

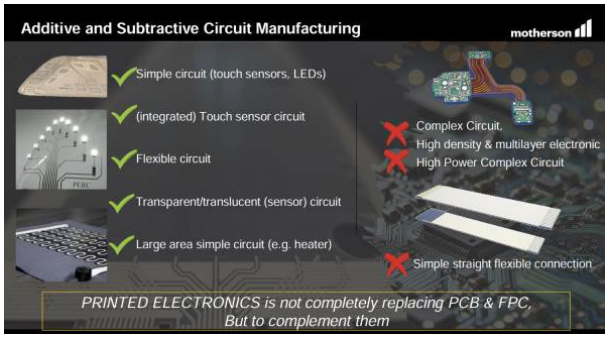
Pros: Unique pillar-to-pillar light stripes, standard and flexible solution, easy to adapt to all part designs, reduced cost to invest, develop, and integrate, compactness, light weight, and simple design.

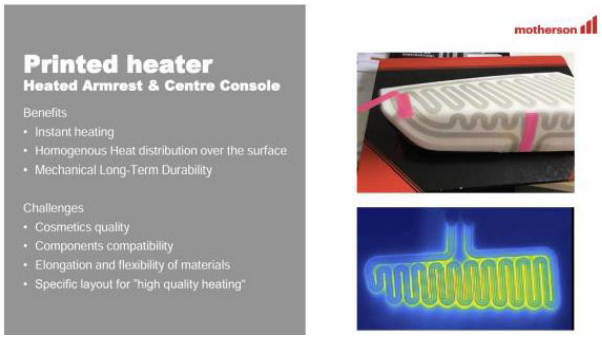
Cons: Silver ink usage for the traces, high impedance (voltage drop with printed electronics), cost, difficulty with pick & place and electronic components, mechanical resistance on film using glue, and thermal dissipation.

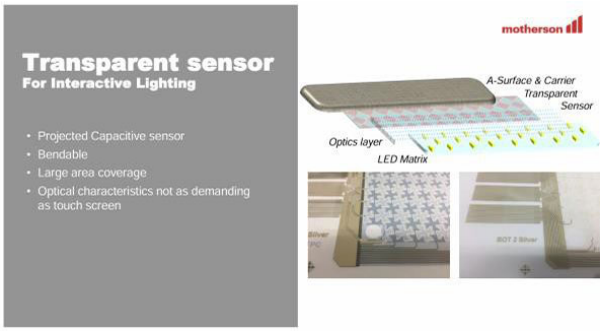
The question of in-mould electronics (IME) versus assembly is also not yet resolved, especially with regard to production (scrap management) and recycling.

To develop this technology, they request LED suppliers' involvement, market evolution on 'smart' versus standard LEDs, qualification for IME, ink and glue suppliers to propose better and cheaper inks and glues, industrial risk analysis and mitigation plans, go-to-market approaches selecting RFQs (ongoing), and printing and manufacturing process dedicated companies. They foresee automotive exterior applications including lit grilles and grilleboards, radomes, and B-pillars.

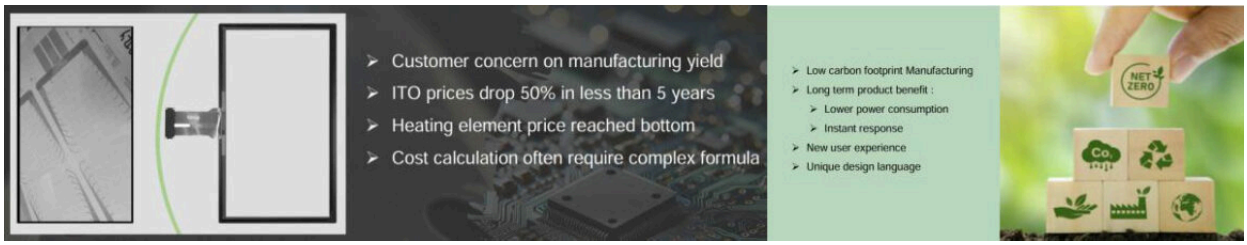
Motherson presented the main challenges for printed electronics and diverse applications.







They mentioned good trends for this technology and a bright future, with mainly two points: IPO connector prices have dropped by half during the last five years, and this technology dramatically cuts the CO_2 footprint of electronics.



To go further ...

ams OSRAM Digital Light Wins Zukunftspreis 2024

To go further ...

This year's German Future Prize goes to the development team of ams Osram from Regensburg. Norwin von Malm and Stefan Grötsch, as well as Hermann Oppermann from the Fraunhofer Institute for Reliability, received the prestigious award for their innovative LED headlight technology, which increases safety when driving.

The winning "Digital Light" is based on a high-resolution LED matrix with 25,600 individually controllable light points. Norwin von Malm says, "Each of these pixels is only half the size of a human hair. And since we want to be able to control each of these pixels separately, each one has to be connected to a power source individually. That was one of the big challenges we had to solve".

Fond Memories of Ad de Visser – A Giant of the Global Lighting Family

LIGHTING NEWS

By Geoff Draper

Having had the honor of cooperating with Ad de Visser, in the field of standardization and regulation of automotive lighting since 1998, I would like to acknowledge a true professional and good friend. He was admired for his dedication to the development of improved lighting and for his determination to continue working past his retirement age, despite fighting his challenging health condition.

I am sure that there will be many references to Ad's long career and involvement in the standardization and regulatory activities, including CIE, CEN, ISO, IEC, GTB and ELMAPS, and his support for governmental representatives. However, I would particularly like to acknowledge his strong support at GTB as the Leader of the Dutch Delegation. Ad also nurtured the cooperation between GTB, ELMAPS, and CIE where he was Director of Division 4.

I remember Ad as a warm, approachable and supportive person, who always found time to share his knowledge and expertise. I also personally remember him as a strong-minded Dutchman who constructively, but firmly, challenged many of my ideas for the restructuring of GTB during my 12-year presidency. Unforgettably he offered to construct the "crash barriers" for me if he sensed that my intentions were becoming too extreme, but I was not sure whether this was a vote of confidence or polite opposition!

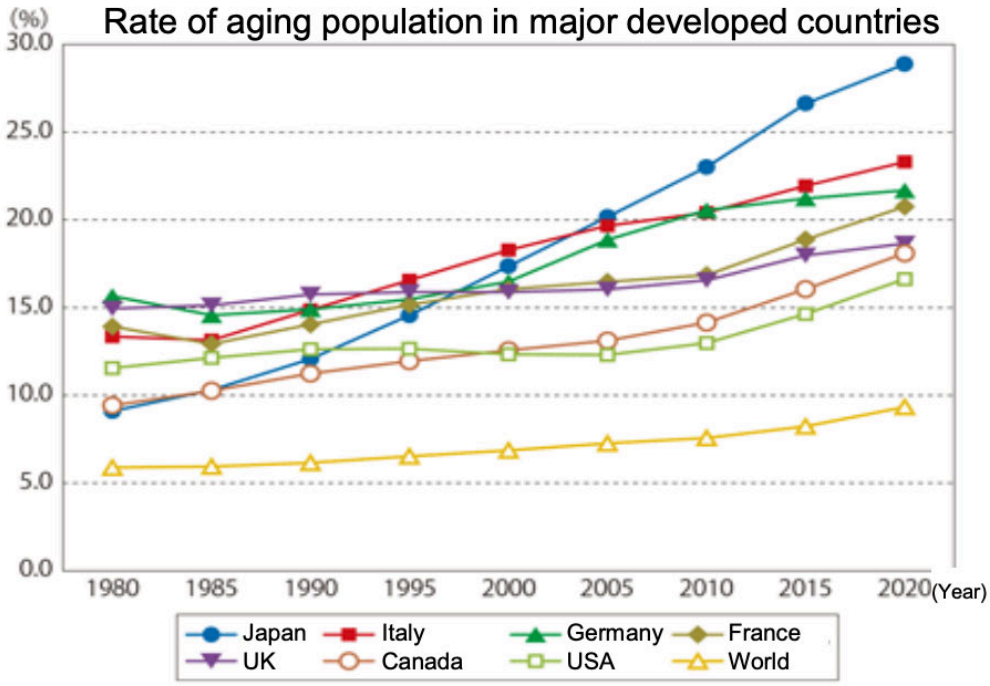
It is always a difficult time to learn of the passing of a good friend or colleague, but we can feel privileged to have been part of Ad's professional life. Our thoughts go to Ad's wife and family, who will get great comfort from his many achievements that have made a real difference to traffic safety.

GRE 91st Session: Japan's Perspective on Glare, Part II

LIGHTING NEWS

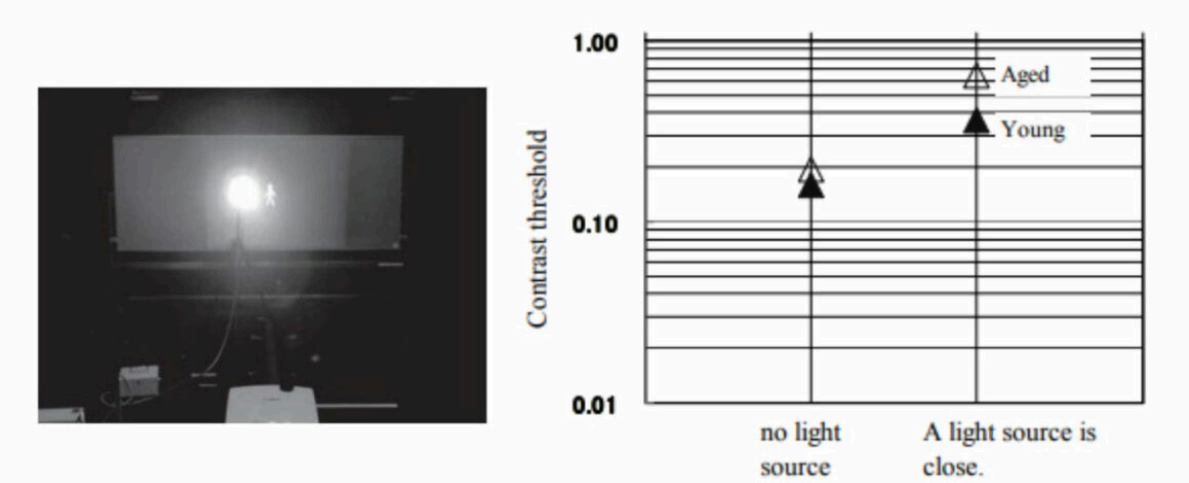
By Paul-Henri Matha

During GRE 91st session in October, on the glare topic, Japan presented its report "Research on Standards for Automotive Lighting in Aging Society" (document GRE-91-17), to evaluate the glare phenomenon in relation to the increasing age of the road users and to suggest possible solutions.



Background of the study is the increasing age of road users in the world and the fact that elderly people are more affected by glare. This means for a given oncoming car with low beam, the discomfort glare perception varies with observer age.

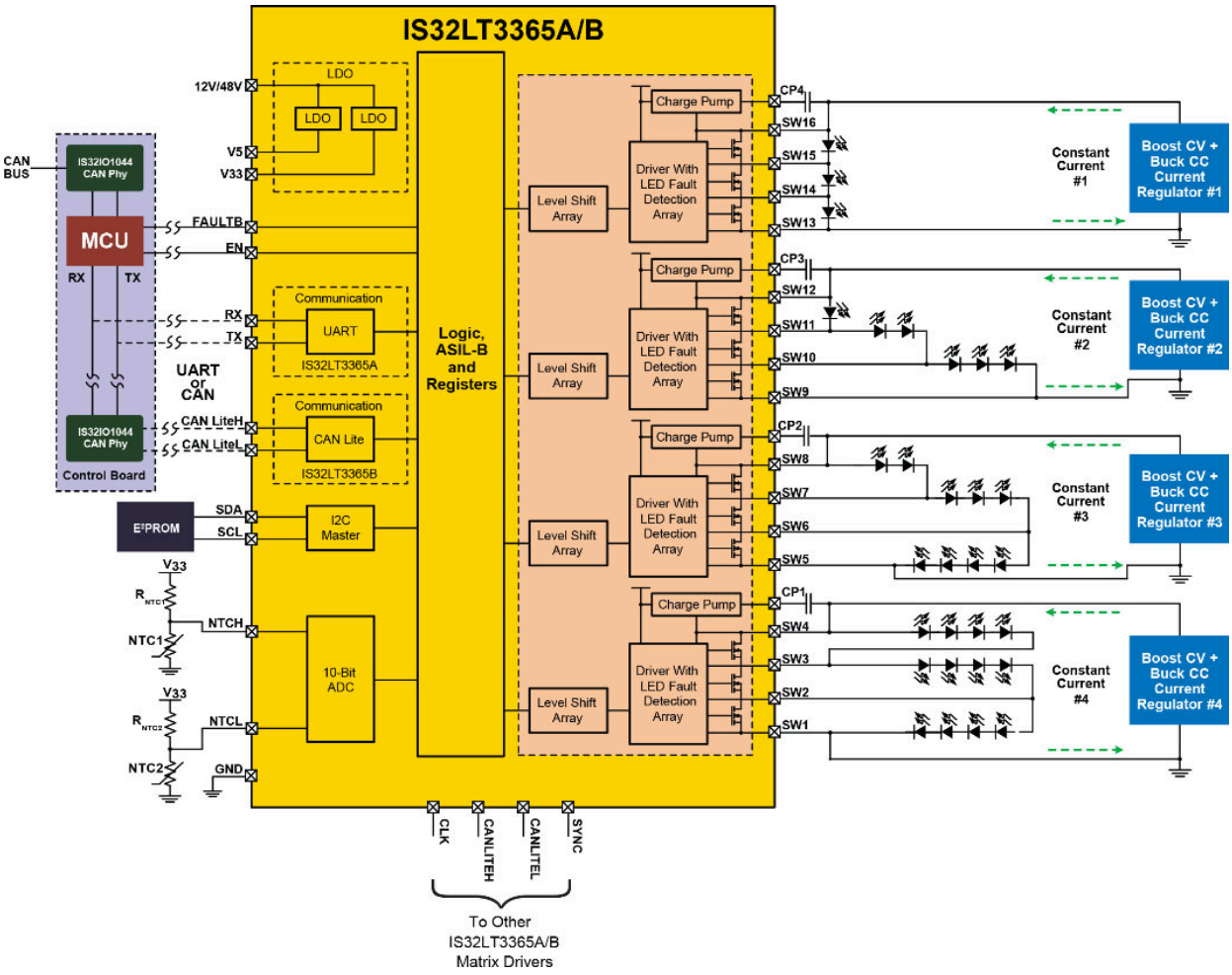
Experiments were done to be able to detect a pedestrian at 60 metres when driver is glared at the same time by oncoming vehicles. The results show that detection of the pedestrian is similar for older and younger drivers when there is no glare but reduced significantly when the older driver is glared.



As explained by Japan, this oncoming vehicle glare can come from headlamp misaim induced by vehicle load, or by dirty headlamps. Technical solutions could reduce glare like new light distribution design, automatic levelling, ADB, and headlamp cleaning systems.

Lumissil's LED Matrix Manager for ADB

LIGHTING NEWS



In a standard matrix ADB system, the architecture is usually divided into two primary components: the LED control module (LCM), and the LED Module (LM). The LCM collects data from vehicle sensors to calculate the light distribution and send the control signals for the LEDs via a sub bus to the LM. The LCM also provides a stable current on the voltage level needed for the LED strings to the LM.

Lumissil have a new lighting matrix manager (LMM), the IS32LT3365. It offers features which help to manage the LEDs and the interaction with the LCM in a safe way:

• It includes CRC (Cyclic Redundancy Check) on the communication bus for robust data transfer. CRC is important for robust data transfers in noisy automotive environments due to its ability to detect transmission errors, such as bit flips or burst errors. It ensures a standard way for data integrity in safety-critical vehicle systems like headlamps, by preventing corrupted data from causing potentially dangerous operating conditions and enabling detection and retransmission of faulty data.

This CRC is one important feature for new lighting EE-architectures designing a no-ECU headlamp by implementing the functionality of the LCM in a domain or central controller and communicating with the LM via UART over CAN.

• Reduced EMI with programmable slew rate of switch transitions and spread spectrum of the PWM. PWM is the preferred method for LED control, using variable duty cycles to achieve precise brightness adjustment. Slew-rate control and spread spectrum have been proven to effectively reduce EMI in PWM-driven LED systems. By adding slew

rate control capability, designs using the IS32LT3365 will have improved LED performance with less EMI.

The new LMM comes in two versions: the "A", which includes a multi-drop UART, and the "B", which features a CAN lite serial interface for control and management by a master microcontroller. The CAN lite interface supports UART protocol over CAN transceivers, enabling robust inter-board communication. An I2C interface is also included for accessing an external EEPROM that stores LED and system calibration data. The device has a 10-bit ADC with multiplexed inputs for monitoring supply voltages, and two external NTC analogue inputs for tracking system or LED temperatures, aiding in LED binning.

The IS32LT3365 has twelve 20V floating NMOS FET switches, designed specifically to operate without a fixed connection to ground or a defined voltage level at either the source or drain terminals. These switches are organized into four substrings, each comprising three NMOS switches connected in series, allowing their voltage potential to vary (float) relative to the reference voltage and ground. This enables the bypassing of individual LEDs or LED stacks, offering flexibility in managing different LED configurations.

Huawei’s Maextro S800

LIGHTING NEWS

Maextro is the fourth brand in Huawei’s Harmony Intelligent Mobility Alliance (HIMA), developed in collaboration with JAC Motors. HIMA already sells cars from three brands: Aito (Huawei & Seres), Luxeed (Huawei & Chery), and Stelato (Huawei & BAIC).

The S800 has L^3 partial driving automation capability, with a roof-mounted lidar unit. As for lighting, there's Huawei Xpixel technology, including DLP projection as already seen on Autio M9. Xingyu make the front lamps, and Varroc TYC make the rear lamps.

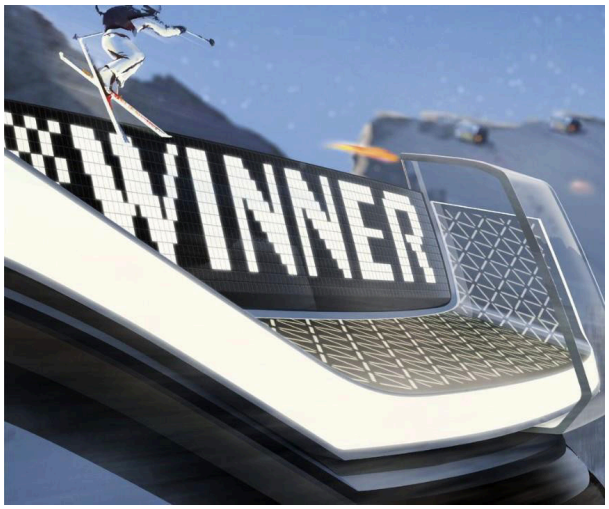
Signalling functions include thousands of stars in the front and rear position lamps, and in the door handles as part of the courtesy lamps.

GAC Trumpchi S7

LIGHTING NEWS

GAC's Trumpchi S7 five-seater SUV made its debut at the Guangzhou Auto Show this year; its official launch will be in the first half of 2025. It has a 2.6-metre-long light strip, and a third-gen PHEV system with 4WD and over 1,000 km of mixed range.

This is the first GAC vehicle to include an ISD, with more than 2,000 LEDs. Functional lighting is provided by a biLED module in each headlamp.



GAC Hyptec HL

LIGHTING NEWS

The new GAC Hyptec HL seven-seat electric SUV was first shown at this year's Guangzhou Auto Show.

There's a prominent ISD grilleboard, and a lit logo. The ISD is fully integrated in the bumper, with light through the body colour. What is new compared to the Geely Galaxy E5 or Dongfeng's Epi008 is that it may be used as a screen to display messages like "Hello" on the pictures, even if the pitch is quite large (estimate: 20 mm).

This ISD is also part of the front position lamp, respecting the 75mm between each lit area.

Mahindra BE 6e and XEV 9e

LIGHTING NEWS

Mahindra's BE 6e and XEV 9e are two electric coupé SUVs with modern styling and advanced technology features, set to reach Indian dealerships in 2025.

Both models have full LED headlamps, slim front and rear position lamps, lit logos (including the steering wheel logo), a lit roof, and an ISD integrated in the rearlamp—the first in an Indian car.

Lamps were developed in India by domestic suppliers like Uno Minda, Lumax, and MMLI. This is clearly showing the trend on Indian vehicle with more and more modern feature, and especially lighting.

New CIE Standard for Car Light-Lamp-Reflector Photometry

LIGHTING NEWS

International Commission on Illumination
Commission Internationale de l'Eclairage
Internationale Beleuchtungskommission

Last week Thomas Reiners*, Chair of Technical Committee TC2-67 in CIE's Division 2 and recently appointed Chairman of the GTB photometry working group, informed the GTB community about the publication of the new International Standard CIE S 027:2024.

The new standard was prepared by TC2-67, a technical committee with members from the GTB photometry working group and individuals from national metrological institutes, technical services, and equipment manufacturers. The goal was to create an internationally-recognized standard applicable to testing of vehicle lighting devices and retro-reflectors.

CIE S 027:2024 is the first truly international standard providing requirements for performing reproducible photometric and colorimetric measurements on road illumination devices, light-signalling devices, and retroreflective devices to be used on road vehicles. It also provides guidance on reporting the data, and lists major equipment, instrumentation and procedures for recording the properties of approved lighting devices according to requirements specified in corresponding UN Regulations —though it can be equally applied for testing according to other national or international standards.

The availability of reliable and accurate photometric data for the homologation or certification of road illumination devices, light-signalling devices, and retroreflective devices is a basic requirement for comparability between industry and test facilities as well as between technical services and approval authorities. By obtaining these data through measurements under specific normalized measuring conditions, the consistency of the data should be ensured between different laboratories within the limits of the declared measurement uncertainty.

This International Standard aims, in particular, to cover measurement methods for testing the compliance of approved road illumination devices, light-signalling devices and retroreflective devices with the photometric and colorimetric requirements as stated in various regulations for a range of lighting applications in road vehicles. For each photometric and colorimetric property, the possible data acquisition process(es) with their uncertainties are considered individually.

Although CIE S 027:2024 focuses on lighting equipment for road vehicles, it can also be used for conformity testing of any lighting equipment, such as navigation lights, airfield lighting, light-signalling equipment for traffic control, or retroreflectors used in public areas.

This International Standard is in English. It has 86 pages, 38 figures, and 14 tables, and it is readily available from the CIE Webshop or from the National Committees of the CIE.

CIE and GTB are currently discussing whether it would benefit the community to set up training sessions on the application of the new standard in approval or in COP testing. Dates to be considered are one of the next GTB meetings or the CIE Midterm Meeting in Vienna next summer.

*In daily life, Thomas Reiners works for LMT Lichtmesstechnik GmbH in Berlin. He has been active in GTB and CIE during the past 20 years. His background is a PhD in physics. Before his time at LMT he had global responsibility for the Automotive Lighting Application Department at Osram.