

Innovative approaches for flexible electronics

On 30 September, a hybrid event (digital and physical attendees) was held at the premises of INOCON in Attnang-Puchheim, Austria. OPE journal talked exclusively to Paul Sparenborg from the LED technology pioneers at Lumitronix, who gave a lecture at the seminar

OPE journal: Mr Sparenborg, the event on “Selective plasma metallization of flexible printed circuit boards” took place at INOCON Technologie GmbH. What is your relationship with that company and why does it make sense for Lumitronix to collaborate with them?

Paul Sparenborg: INOCON is our most important technology partner. The company holds several key patents in the field of plasma technologies and produced the fully automated reel-to-reel plasma coating line. Selective plasma metallization, which is processed by INOCON according to our layout specifications, is the basic process for our reel-to-reel assembly of components using the reflow process.

We are the exclusive supplier worldwide for the flexible modules based on the patented technology of selective plasma metallization. In this context, I would like to highlight our other valued partner within our consortium: PLASMA INNOVATIONS, which is intensively engaged in the basic technologies of flexible base materials and plasma powder coating. Together, INOCON, PLASMA INNOVATIONS and Lumitronix research and develop innovative approaches for flexible electronics.

OPE journal: Your company's main contribution to the seminar was the presentation on “Innovative LED modules and battery cell connectors on flexible boards”. How does this presentation complement the other topics of the day?

P. Sparenborg: Our aim was to show flexible products that are already being produced in series in our facility for the mass market. We have highlighted the advantages of selective plasma metallization for further processing in reflow soldering on our reel-to-reel production line.



Paul Sparenborg, sales director at Lumitronix



Impressions from the INOCON event

The participating experts also gave an outlook on future trends. We learned that there are many exciting fields on the market that are currently in a very early stage of development. For us it was good to hear that our development work is fertilising the needs of the industry.

Just to name a few of the approaches for the future: Today we are working intensively on transparent modules, flexible infrared applications, various sensor solutions and hybrid circuit boards. Our entire development work is based on the process of plasma metallization, and the end products will be offered on reels on a large scale.

OPE journal: Let's get into the details: Lumitronix is considered to be an LED specialist of the first hour, with soft- and hardware development and production at its site in Hechingen, Germany. What can your company offer to its customers in general – and to the attendees of the INOCON event in particular?

P. Sparenborg: In addition to our standard products, which, historically, are mainly equipped with LEDs and are aimed at the classic lighting market, we see ourselves as a supplier for the entire industry. We do not shy away from any challenge in the field of flexible electronics and today we handle numerous customer-specific requirements within the framework of development projects and contract manufacturing. The assembly of electronic components on flexible materials can reduce the complexity of the end product and enable new functions. We consider our technologies to be a unique added value for the entire business. Our goal is to bring challenging and at times futuristic requirements of our customers quickly and reliably to the mass market.

OPE journal: Can you point out a few applications of your LED technologies?

P. Sparenborg: One application we are increasingly serving these days is large linear luminaires for public areas and offices. This is where our flexible technology scores and enables a slim design of the virtually limitless LED board with good efficiency at lower costs. Furthermore, we are supporting a growing number of projects for large area lighting, such as illuminated ceilings and light panels. Simple installation and weight savings are good arguments to rely on our flexible boards. In general, it can be said that all applications that require flexible PCBs, because they have to be specially shaped or are in motion, can get good solutions with our technical approach.

Last but not least, we are in contact with many lighting designers because they can realise innovative lighting concepts with our flexible base materials. In order to serve the movement towards sustainability, solutions made entirely from sustainable materials are highly in demand. Our in-house development project to create a luminous lampshade has met with great interest and is currently being pursued by various lighting manufacturers.

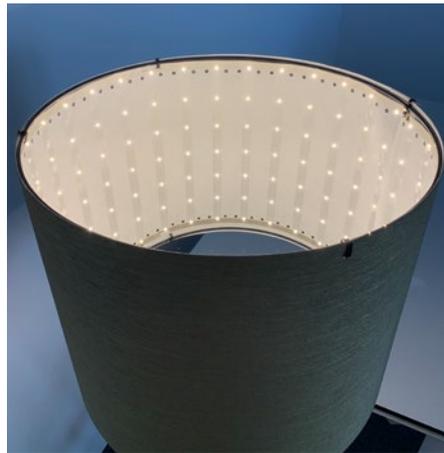


Fig 1a: A flexible LED board made of paper combined with a décor layer results in an innovative approach for a lampshade

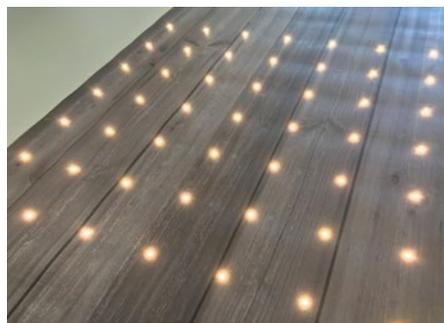


Fig 1b: Décor options on flexible base materials open up new design possibilities

OPE journal: Large lengths, few single parts and continuous layouts – these are the main advantages of your LED modules which you pointed out in your presentation. Can you provide some more technical data on these modules?

P. Sparenborg: Our flexible Z-Flex LED module with dimensions of 280x20mm, for instance, promise a significantly easier installation than the usual rigid LED modules. The flexible LED strips are based on the popular Zhaga standard of modules with a length of one foot and are therefore compatible with many existing linear luminaire types. Unlike rigid modules, which must be fixed in large numbers with screws, the Z-Flex LED strips can be glued into the housing in one piece. Another advantage over modules based on rigid boards is the wiring. The Z-Flex modules can be operated up to a maximum length of 1.4 metres with one feed. Moreover, the production lengths of up to 56m result in considerable savings for companies in the lighting industry, especially in cost centres such as warehousing and transport.

The square-shaped version of Z-Flex with dimensions 280x280mm is suitable for large-scale applications. Also here we offer considerable advantages in terms of processing and cost management since the production in roll form minimises storage and transport as well as installation effort. Furthermore, both Z-Flex versions can be powered with a low voltage of 24V and are therefore safe to touch.

OPE journal: What are the core elements of your flexible printed circuit boards?

P. Sparenborg: A flexible circuit board basically consists of a carrier and an electrical conductor. As carrier we can use different base materials such as polyimide, PET and paper. We also process many customer-specific flexible materials after a feasibility test.

Depending on the application, we use copper, aluminium or conductive “silver paint” as the electrical conductor. Aluminium and silver tracks can be cost-effectively applied to the flexible base material and are made solderable with our process of selective plasma metallization.

Optionally, we supplement our flexible PCBs with insulation materials and décor layer which is printed or made of a specific textile.

OPE journal: Can you take us through the production process for your flexible boards?

P. Sparenborg: Our production line serially equips basic material that is present in the form of reels. We work with substrate widths of 150mm – 500mm and virtually endless lengths. However, the lengths must be logistically processable, our current unwinding unit can handle a roll weight of up to 150kg. Presently processed thicknesses of the material are between 10µm – 150µm.

These reels are chucked at the beginning of the lines and tightened along the entire length by clamp supports – also referred to as hitch feeders – so that the further processes of coating with solder paste and equipping with LEDs and other components may be performed smoothly.

We do process a wide range of different components; at present we are limited in size: 27x27mm with a maximum component height of 8.5mm. The placement speed currently reaches 52 500 components per hour. Upon the step of equipping, the flexible printed circuit boards are soldered in an infrared oven and then checked electronically and



Fig 2: A lightweight – this segment (50x350mm) contains seven LEDs and weighs about 2 grammes

optically by a machine. Afterwards, the flexible printed circuit boards may be cut to individual lengths and different patterns, respectively, by oscillating blades.

Our line is designed for large-scale production. For smaller quantities we can also offer sheet-to-sheet assembly in the initial development phase. However, from the very beginning we design all processes and material combinations in a way for them to be reproduced in reels as well.

OPE journal: Finally, one of your most well-known products is the Paper-Flex LED wallpaper. What can you tell us about this?

P. Sparenborg: Our Paper-Flex is a future-oriented product that uses paper as a sustainable and environmentally friendly basis. This makes the paper module a novelty in the industry, enabling it to be used in a wide range of applications. We have a standard version of Paper-Flex in our portfolio and do offer numerous customer-specific paper solutions for different kind of purposes.

The paper modules to be adhered can be installed in a time-saving manner and are also touch-proof due to the low voltage of 24V. In addition, the extremely low weight and the roll shape ensure that storage and transport costs are significantly minimised. Moreover, the paper substrate is ultra-flat (approx. 0.8mm after assembly) and thus more than suitable for large-area applications where a low installation height is required.

The diffusion openness of Paper-Flex is a decisive factor in ensuring that the paper modules can be used as wallpaper. Due to the breathability of the paper there is no danger of moisture accumulation. Currently our paper module is being presented as an LED wallpaper to various DIY stores in Europe and we are confident that our product will soon find its way into many living rooms!

Image sources: Lumitronix

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