NOVACENTRIX INSPIRES, INNOVATES AND DELIVERS THE LATEST IN PRINTED ELECTRONICS APPLICATIONS

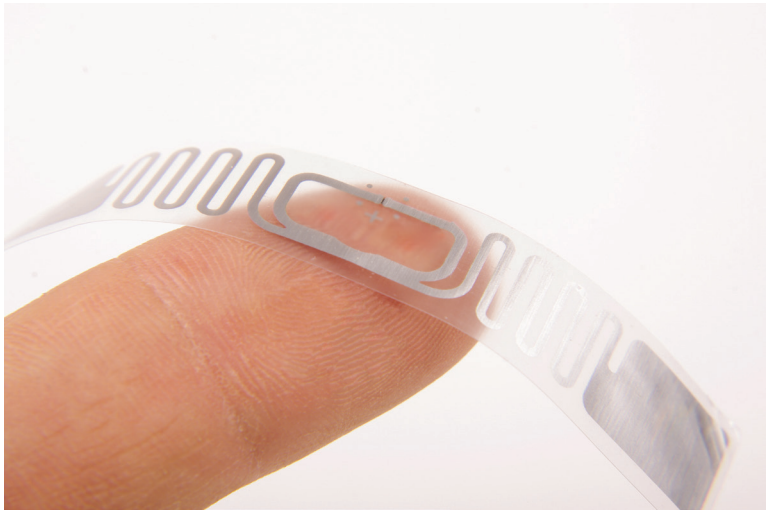
BY DEB DALTON, MARKETING AND EVENTS MANAGER, NOVACENTRIX

Headquartered in Austin, TX, NovaCentrix offers industry-leading photonic curing tools, conductive inks, material and expertise that enables the development and production of next-generation printed electronic devices. The NovaCentrix team develops, patents, and commercializes new technologies in printed electronics, nanoparticle manufacturing, pulsed power equipment, and related fields. Its science and engineering team has decades of cumulative experience, and it continuously strives to create class-leading technologies, such as PulseForge® tools and Metalon® inks. "We work to enable every customer to succeed in their efforts," said Stan Farnsworth, Chief Marketing Officer. "If we can add products or capabilities or make improvements for our customers' benefit, we will do it."

Munson added that NovaCentrix's innovation continues with frequent product enhancements, upgrades, and accessories across all of its products. Additionally, the company's well-equipped print-and-cure lab has flexo, screen, inkjet, spray and other ink deposition technologies for client use. NovaCentrix welcomes processing of samples and pilot rolls with the assistance of its team of process engineers.

The company's customer base includes consumer and military electronics manufacturers as well as academic and scientific research and development organizations. These manufacturers and organizations are scattered across the globe from Europe, Asia, and India to the United States. Its customer sales and support teams are located in China, South Korea, Germany, Netherlands, and the United States. NovaCentrix's design and manufacturing center is located in Austin, Texas.

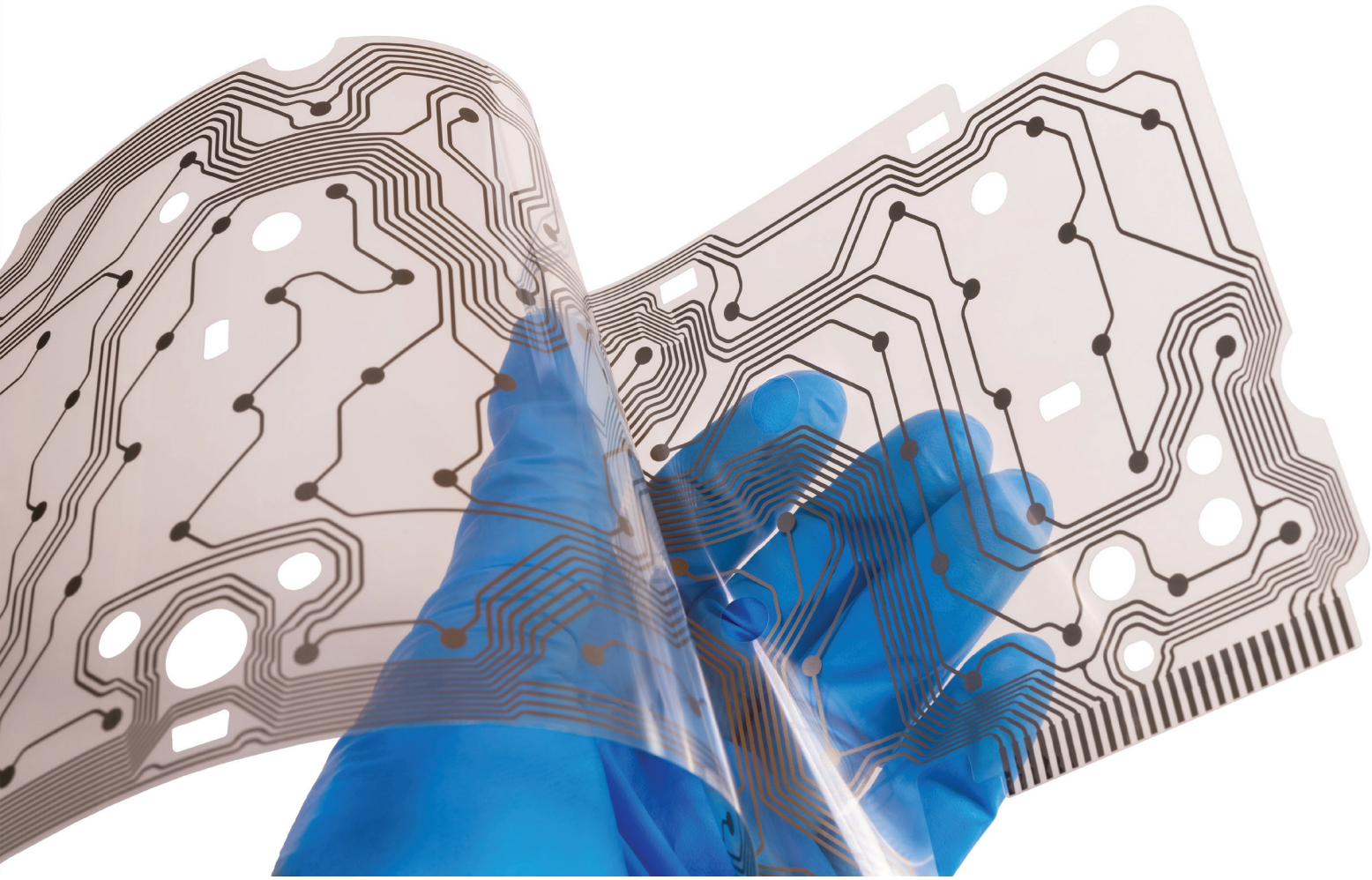
The company prides itself on being a true partner with customers. "We partner with customers to take ideas from inception to full production," Farnsworth,. "Our technologies continue to revolutionize the printed electronics industry through photonic curing, which enables product



innovators and manufacturers the option of flexible, low-cost substrates and functionality not possible with conventional ovens and lasers."

NovaCentrix is known for inventing photonic curing, which is the high-temperature thermal processing of a thin film using pulsed light from a flashlamp. When this transient processing is done on a low-temperature substrate such as plastic, paper or glass, it is possible to attain a significantly higher temperature than the substrate ordinarily can withstand under an equilibrium heating source such as an oven. "Our team has pioneered a new genre in high-speed, high-temp materials processing, which now enables a myriad of consumer devices," said Farnsworth.

NovaCentrix's latest development, the PulseForge Soldering toolset is the result of a technology partnership with the Holst Center and enables soldering onto temperature-sensitive substrates such as PET, paper and PEN, TPU and fabric, using standard SMT components and standard lead-free solder pastes, – in seconds, not minutes. Revolutionizing



> OUR TECHNOLOGIES CONTINUE TO REVOLUTIONIZE THE PRINTED ELECTRONICS INDUSTRY THROUGH PHOTONIC CURING, WHICH ENABLES PRODUCT INNOVATORS AND MANUFACTURERS THE OPTION OF FLEXIBLE, LOW-COST SUBSTRATES AND FUNCTIONALITY NOT POSSIBLE WITH CONVENTIONAL OVENS AND LASERS.

conventional and laser soldering methods, this new SMT pulsed light solution stands to disrupt current methods for soldering commercial electronics.

NovaCentrix's patented pulses of high intensity light are used in place of conventional soldering and laser methods. Solder is heated to its liquidus temperature in milliseconds – without damaging the underlying substrate. And with the lamps' large coverage area, multiple LEDs, as an example, can be soldered simultaneously – unlike 'one-at-a-time' laser options. Additionally, this provides immediate cooling, resulting in a stronger bond. The tools work with conventional lead-free solders and, with its milliseconds process, substrates stay cool, providing the flexibility of soldering onto low-cost, flexible, thermally sensitive substrates.

PulseForge tools simultaneously solder commercial electronic packages over a wide area and orders of magnitude faster than conventional reflow processes, making it R2R compatible. In the manufacturing arena, the new PulseForge soldering tools can be used in 3D fabrication, automotive, consumer electronics, displays, IoT, photovoltaics, product packaging and wearables.

The PulseForge tools are already being used to dry, sinter, and anneal thin-film materials on substrate materials such as polymers and paper. The tools also drive UV processes, and initiate and modulate reactions in materials such as the Metalon ICI-series of copper-oxide reduction inks. These tools are intended for product innovators and manufacturers in printed electronics who need options for the traditional use of materials and processing tools such as ovens or lasers. The use of PulseForge tools can save time and money, while enabling new types of products in applications like solar, RFID, displays, smart packaging, wearables and even flexible circuits.

Customers consistently choose the PulseForge because its micro-second/millisecond processing times and large-area processing provide increased production throughput, which results in better device performance due to higher temperatures in sintering, soldering, and curing. Additionally, with the flexibility of choosing less expensive, temperature-sensitive substrates, they see an immediate reduction in materials cost. "Our solutions inspire flexible, stretchable, lightweight devices and form factors," added Farnsworth.

Prior to purchase, the company's PulseForge tools can be evaluated at its facility with minimal arrangements, at noted events in the United States, Europe, and Asia, or through a flexible lease program. NovaCentrix routinely

works with global organizations as well as startups and institutes on projects ranging from initial concept exploration all the way to full production. Additionally, because the printed electronics space is quickly evolving, it can adapt and shift its product capabilities as required.

NovaCentrix's additional advanced technology products include:

- Pulse Design: NovaCentrix has created the world's first integrated photonic curing simulation. SimPulse® is an interactive numerical model for PulseForge photonic curing tools. It decreases process development time and reduces the number of samples needed for optimization. SimPulse reduces trial and error, and allows users to close the loop. This technology is included with every PulseForge tool but also is available separately.
- Conductive Inks: Metalon conductive inks capitalize on advanced materials and formulation to provide conductivity options for additive manufacturing of printed electronics like photovoltaic devices, RFID, smart cards/labels, displays, and advanced packaging. Metalon inks with solderable, resistive, magnetic and stretchable conductive properties also are available. Using nanoparticles and flakes, Metalon inks are available in off-the-shelf formulations as well as custom formulations for specific applications and print methods. Currently developed variants include silver inks suitable for application by inkjet, screen, flexographic printing, and gravure. Copper-oxide reduction inks also are available for the same applications. Metalon inks can be selected based on desired substrates, performance, and cost.
- Nanopowders: NovaCentrix manufactures nanosilver powder for both the conductive ink market and biological uses. The materials have numerous advantages including tight size control, high purity, and excellent dispersability. The company manufactures silver nanopowder, which is used in electrically conductive inks for inkjet and flexographic printing. Silver also has been shown to have antimicrobial properties. Applications include electrically conductive inks and adhesives for photovoltaics, displays, energy storage, RFID, and smart packaging.

"NovaCentrix's products are at the forefront of innovation for printed electronics tools and material," concluded Munson. "For us, it is not enough to just talk about innovation, we want to deliver. Our products, technologies, and team are enabling printed electronic applications worldwide."

www.novacentrix.com