



Advanced Curing for Printed Electronics

CURE INKS AND FILMS AT ROOM TEMPERATURE IN LESS THAN A MILLISECOND

Now You Can with PulseForge™ Tools

- Cure metal inks on low-temperature, low-cost substrates like paper
- Cure in-line at print speeds
- Cure copper inks



Advanced Curing for Printed Electronics

PulseForge™ 1100 System

The PulseForge 1100 is the first commercially available product using the Photonic Curing™ process, a revolution in printed electronics. PulseForge tools sinter metal-based inks and coatings on thin-film substrates, achieving remarkable conductivities. It takes only milliseconds, and does not damage even low temperature substrates, including paper, PET, and polyethylene.

PulseForge systems for printed electronics lower the cost for current printed RFID, display, packaging, and solar products, and open doors for new applications and products, with new materials, on new substrates.

Shedding Light on a New Technology

PulseForge tools work because of the energy delivered by the high-intensity strobes at the heart of the system. The strobes are driven by high-powered pulse electronics technology resulting from years of engineering, and are unlike anything on the market today. The strobes deliver energy to the target surface, selectively heating and fusing ink particles, and forming highly conductive pathways. Since the technique is broadcast by nature, no critically aligned optics are required. The Photonic Curing

process specifically targets inks and thin-film depositions, functionalizing them without heating or damaging the substrates on which they are printed, or affecting nearby thermally sensitive components. This allows a large-area complex pattern to be instantly cured even on low temperature substrates. PulseForge technology is effective with all types of particle-based inks, whether nanoparticle-based or metal-based.

Performance in the Spotlight

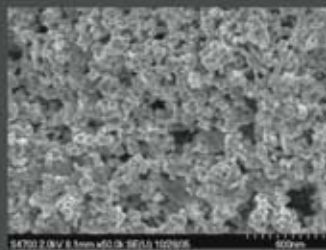
Copper-based inks

PulseForge equipment allows copper-based inks to become a reality. Sheet resistances below 100 milliohms per square and resistivities as low as 10X bulk have been attained with NovaCentrix Metalon™ copper-based inks. PulseForge systems enable the manufacturing of printed copper conductive patterns in ambient air, without using an inert atmosphere. A protective over-layer may then be applied after curing to enhance long-term performance.

Silver-based inks

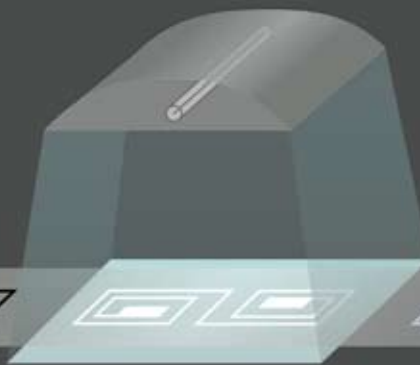
Sheet resistances as low as 20 milliohms per square and resistivities as low as 4X bulk have been attained with NovaCentrix Metalon™ silver-based inks. Metalon inks are optimized for use on paper.

PULSEFORGE TECHNOLOGY SINTERS INKS



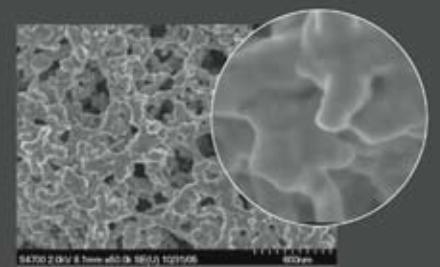
Before PulseForge Curing

Poor or no conductivity



Flash Power Delivery

- Discharge up to 15 megawatts of energy
- Deliver in less than 1 millisecond
- Sinter the inks
- Protect the substrate, even paper and PET



After PulseForge Curing

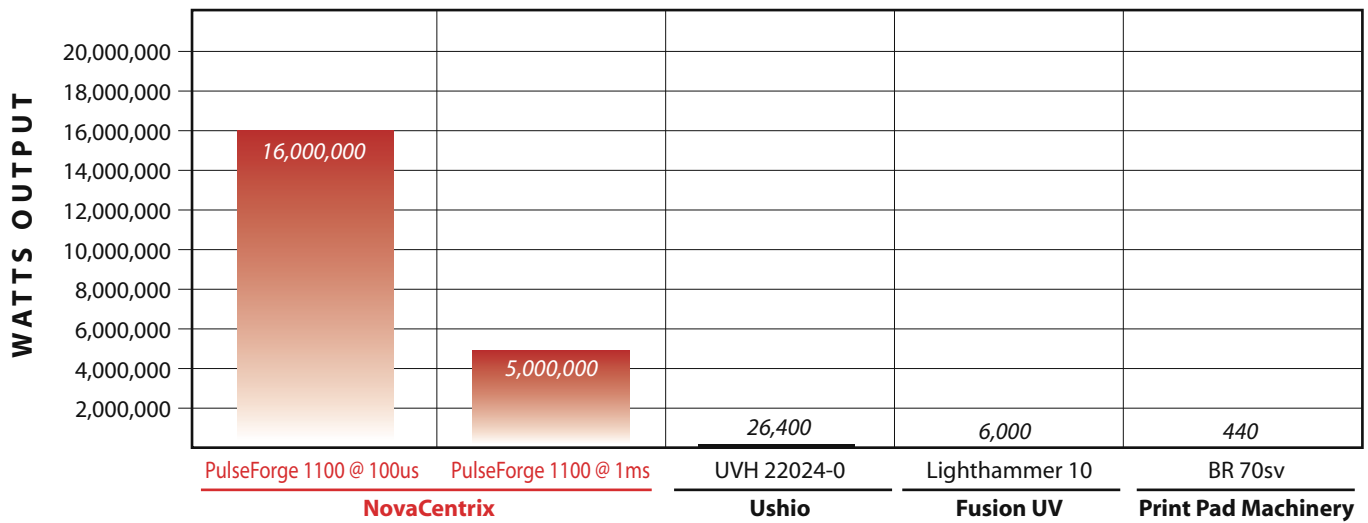
High conductivity

Partial List of Compatible Systems

PulseForge tools are compatible with the following types of materials and processes:

Plastics	Paper	Conductives	Print Methods
<ul style="list-style-type: none"> • PET • Polyimide • Polyethylene Film • Polycarbonate • Polystyrene 	<ul style="list-style-type: none"> • Photo Paper • Copier Paper • Label Paper 	<ul style="list-style-type: none"> • Silver • Copper • Other Metals 	<ul style="list-style-type: none"> • Inkjet • Gravure • Flexographic

Curing System Power Output



- NovaCentrix PulseForge is pulsed output; others are continuous output
- Power values for PulseForge are based on energy output for durations of PulseForge 1100 adjustable pulse
- Pulsed output is required to sinter inks without damaging substrates
- Data taken from respective company web-sites

Advantages of PulseForge over Traditional Methods

	PulseForge	UV	E-Beam	Thermal
Cure below 50 degrees Celsius	✓	✓	✓	—
Cure in less than one millisecond	✓	—	✓	—
Sinter metallic inks on low-temperature substrates	✓	—	—	—
Cure rate equal to print rate	✓	✓	✓	—
Effective for true metallic inks	✓	—	—	✓
Effective for semi-conductive materials	✓*	—	—	✓
Effective for organic inks	—	✓	✓	—

Properties most suitable for printed electronics

* Has demonstrated a significant conductivity improvement in amorphous-Si

PulseForge Systems for Metallic Inks and Films



PulseForge 1100

Purpose

Application and materials development for flexible electronics including RFID, smart cards/labels, displays, photovoltaic devices, and advanced packaging.

Key Specifications

- Adjustable exposure level
- Adjustable strobe energy
- Equivalent max power up to 16 megawatts
- Adjustable strobe pulse duration
- Exposure area 2 cm wide x 12 cm long
- Strobe height above sample adjustable from 0.5 cm up to 20 cm
- Manual substrate positioning stage
- Enclosed and interlocked strobe region for personnel safety
- Power supply requirements: 220VAC, 3-phase, 30 amp



PulseForge 3100

Purpose

Roll-to-roll web manufacturing with integrated deposition and curing capability.

Key Specifications

- Adjustable web speed to 200 fpm
- Adjustable strobe energy
- Adjustable exposure height
- Web widths from 15cm to 180cm in 15cm increments
- Suitable for use on new or existing inkjet, flexo, gravure and screen print lines

See what PulseForge can do for you!

PulseForge Evaluation

- No-risk evaluation of PulseForge with your inks and printed substrates
- Performed by NovaCentrix at our facility on our tools
- Ideal for determining initial potential of PulseForge with your applications and processes

PulseForge Services

- Quick access to PCS tools at NovaCentrix by the hour, with package rates available
- Assistance from the NovaCentrix application engineering team
- Ideal for short-term projects or feasibility studies

PulseForge Leasing

- Accelerate product development by having PCS access at your facility
- Suitable for extended development programs of specific inks or printed products
- Service and support contracts available

Contact us today to learn more:

Stan Farnsworth at 512-491-9500 x210 or stan.farnsworth@novacentrix.com

NovaCentrix

200-B Parker Drive
Suite 580
Austin, Texas 78728

T: 512-491-9500

F: 512-491-0002

www.novacentrix.com

