PulseForge® 1300

inspire innovate deliver

Photonic Curing Tool for Research and Development

Full-Size Features in a Compact Design

Maximum Control, Minimum Time, Optimal Results

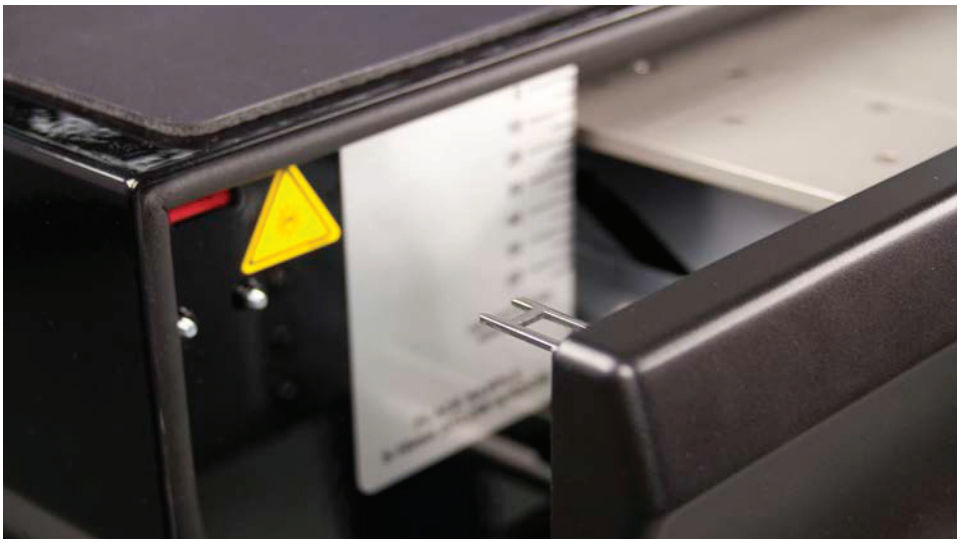
The PulseForge 1300 from NovaCentrix is the state-of-the-art photonic curing tool for research and development. Designed to reflect the experinces our own team of scientists, the PulseForge 1300 incorporates features determined to be essential for peak performance. With advanced multi-touch user interface and wide control of processing parameters, users can quickly optimize material configurations and process conditions.

PulseForge® 1300

The PulseForge 1300 from NovaCentrix offers state-of-the-art photonic curing in a low-cost, compact chassis without giving up performance or safety. Backed by world-class process engineering and support, the PulseForge 1300 is the ideal tool for research and development of printed electronics.

Engineered for Performance, Built for Use

The engineers who created the PulseForge 1300 emphasized safety throughout the design process. Some features, like the redundant optical shrouding around the lamp assembly and the multiple EMO safety pull-switches are readily apparent. Others, such as the sealed and gasketed sample processing chamber, the redundant panel/enclosure interlocks, and the numerous software system checks are less obvious.



Detail showing sealing gasket on sample processing enclosure, drawer-open interlock tab, and sample stage height indicator.

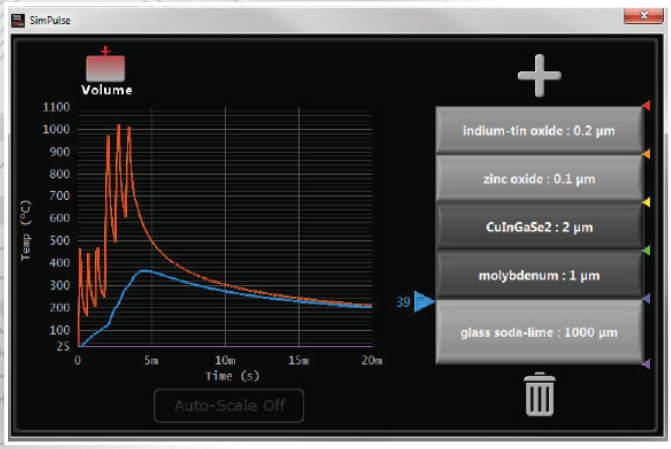
Standard Safety Features

- Fully CE Mark safety compliant.
- Safety interlocks on access panels and sample drawer: power is stopped if opened.
- Safety interlocks and indicators for cooling water: flow and conductivity.
- Obscured light path, no stray emissions.
- Status indicators on-screen.
- Isolated control volume from lamps and rest of cabinet via seals and barriers.
- Sealed drawer opening for capture and control of sample outgas products.
- HEPA-filtration of used process air.
- Output flow can be plumbed via side port.
- Air and inert gas feeds for process area or process chamber

includes SimPulse®

predict | test | monitor | measure | modify

NovaCentrix has created the world's first integrated photonic curing simulation. SimPulse® is an interactive numerical model for PulseForge® photonic curing tools. SimPulse dramatically 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.



Hypothetical multi-layer stack demonstrating application of pulse shaping to achieve two-regime processing.

SimPulse is easy to use.

Because it is integrated into a PulseForge tool using the same interface, using SimPulse is just like using a PulseForge. SimPulse is either standard or an option on every tool in the PulseForge product family.

SimPulse is fast.

SimPulse typically runs in a fraction of a second. This allows one to change variables of the system and see in real time the effect of the changes.

SimPulse is for R&D and production.

The common file format shared by all PulseForge systems contains the variables needed both to run a PulseForge tool as well as SimPulse. Transferring is as easy as a USB stick.

Why Simulate Photonic Curing?

To Save Time and Expense.

- Determine the impact of over 12 process variables on the material stack in minutes, not days.
- Optimize materials thicknesses and architecture prior to extensive design-of-experiments testing.
- Define exposure conditions which maximize lamp lifetime.

Fully Integrated Photonic Curing Tool for Research and Development

PREDICT
Simulate the Photonic Curing Process

Ease of use

SimPulse has the same user interface as the PulseForge tool-set. In fact, integrated SimPulse is either an option or standard on every tool in the PulseForge product family.

Steps to Creating a SimPulse Model

1. BUILD THE MATERIAL STACK
   SimPulse allows material stacks of up to 7 layers to be created. Each layer can be assigned a material type from the reference library, or can be uniquely defined by manually entering the known or estimated thermo-physical properties for that material. Each layer thickness is also defined.
2. DEFINE THE EXPOSURE CONDITIONS
   The interface for defining the exposure conditions is the same as the interface for the actual PulseForge tools. In this way, process conditions can be quickly applied back and forth between the tool and the simulation.
3. REVIEW THE RESULTS
   The output is presented in the form of thermal time curves. The predicted temperature at any point in the depth of the stack can be seen using the slider arrow positioned next to the material stack.

TEST
Adjust All Production Parameters

PulseForge Software Interface

Custom Multi-Touch Operating System and Interface for Process Optimization

To control the state-of-the-art PulseForge 1300, our engineers created a state-of-the-art interface that allows users to manage and monitor all aspects of operation. Key sections include power controls with emergency stop indicator, pulse parameters, operating mode parameters, pulse profile graphic, system messages, photodiode display, and various system status and position indicators. Using the pulse settings for example enables the user to set pulse durations as short as 25 microseconds with increments as low as 1 microsecond, and pulse gaps as low as 20 microseconds with increments of 1 microsecond

Software-Configurable Pulse Modes and Pulse Shaping

Basic

Basic mode issues a single pulse at user specified length each time the machine flashes. This mode is best for curing simple nanoparticle systems with minimal drying requirements.

Pulse Shaping: Engineered Pulses Delivered Within Material Thermal Response Time

Arbitrary

Arbitrary mode allows the user to specify the individual high and low times of each µ pulse. This mode is appropriate for complex multi-layer materials, as well as creating custom thermal profiles such as millisecond-scale ramp-and-soak patterns.

Uniform

Uniform mode divides a pulse signal into a sequence of evenly-spaced µ pulses. This mode is best for processing thicker nanoparticle systems and for flake systems.

Table Height Adjustment

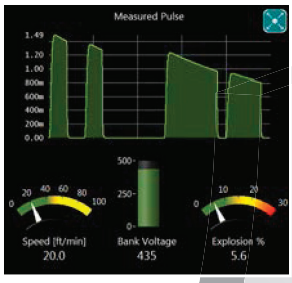
- Table can be raised or lowered 60mm with use of turn dial on front.
- Allows use of taller samples (not just thin sheets), variety of sample chucks (heated, vacuum), and control-volume chambers.
- For changing sample exposure intensity, use pulse control features, not the stage height adjustment, for better uniformity.

MONITOR & MEASURE
Capture Process Data with Ease

Instrumentation Connections

For R&D, it is not just the results that matter, but also how to get there and what is happening to the materials along the way. That's why the PulseForge 1300 is designed and built with flexible data ports and integrated data processing for optional instrumentation accessories. The data ports provide the user the flexibility to utilize their own custom instrumentation. As a standard accessory, a bolometer for measuring the exposure energy is provided.

- Thermocouple ports x2.
- USB data port.
- BNC ports x2.
- Power plug for optional heated chuck.
- Photodiodes record each flash output.
- Built-in data acquisition card.
- Bolometer measures received energy



Pulse Delivery Timing

For research and development with photonic curing, knowing the exact exposure characteristics seen by the sample is critical. That's why all PulseForge tools are built incorporating photodiodes to measure the pulse timing. This data is presented in near-real time, after each pulse, on the touch screen display. The data is also recorded for future reference.

Bolometer test data, obtained through onboard instrumentation connections and data acquisition.

Next-Generation Bolometer

Every PulseForge 1300 includes a custom bolometer for measuring energy delivered to the processed sample. This data is also displayed on the touch screen, and the data can be exported to a user's own storage device.

- Connects to sample stage instrumentation box.
- Designed for rapid signal response.
- Compact size.
- Place on stage simultaneously with samples to measure energy received by samples on the same process run.

Table Position Indicator

- The sample table scans at up to 30 meters/minute.
- The blue LED shows the table location in the enclosure.

PulseForge® 1300 Photonic Curing Tool for Research and Development

Now you can close the loop on the development process.

Integrated Power Supply and Switching

Proprietary High-Power Charging Supplies and Ultra-Rapid Switching

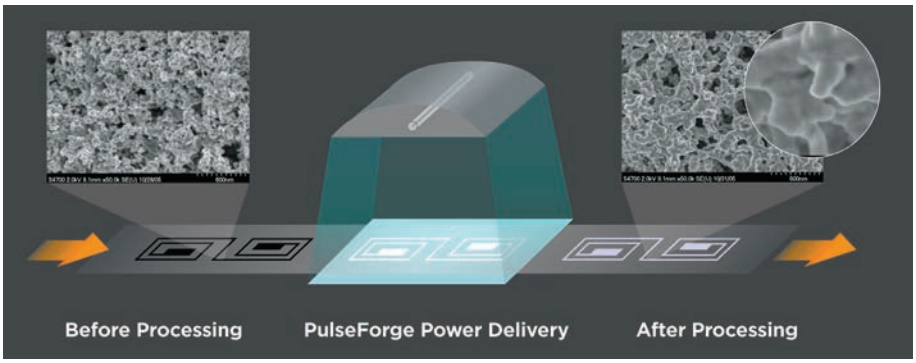
Unsatisfied with the limited capabilities of power supplies available on the market, NovaCentrix engineers developed our own. The power supplies for the PulseForge 1300 are based on those developed for the full-size PulseForge tools, ensuring the scalability of results obtained with the R&D-scale equipment. By building them to a standard size format, they can be easily upgraded or updated to remain state-of-the-art.

Easy-Access Connections

- Signal outputs from sample stage instrumentation.
- Flow controllers for adjustment of cooling air and inert purge.

What is Photonic Curing?

Photonic curing 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 or paper, it is possible to attain a significantly higher temperature than the substrate can ordinarily withstand under an equilibrium heating source such as an oven. Since the rate of most thermal curing processes (drying, sintering, reacting, annealing, etc.) generally increase exponentially with temperature (i.e. they obey the Arrhenius equation), this process allows materials to be cured much more rapidly (in about 1 millisecond) than with an oven taking seconds to minutes. Photonic curing not only allows a dramatic increase in the processing speed, but it also enables the creation of new materials not possible with an ordinary oven as certain limitations of equilibrium thermal processing are eliminated.



Learn more at www.novacentrix.com

Contact NovaCentrix to arrange a personalized demonstration of SimPulse, or for more information about our other state-of-the-art product groups:

- PulseForge® Photonic Curing Tools
- Metalon® Electrically-Conductive Inks
- Contract R2R Print Services

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