IMPULSE® 2-2 Pulsed Power Module

Ultra-Fast High Power Impulse Magnetron Sputtering + Positive Kick™

OVERVIEW

The Starfire Industries IMPULSE® 2-2 is an affordable and versatile pulsed power module that converts a conventional DC sputtering system into a ultra-fast HiPIMS system. The IMPULSE® 2-2 thin-film coating solution ideal for small 1" to 4" cylindrical and linear cathodes providing high ionization fraction and independent control of ion energy to "dial-in" film stress and morphology. High-performance dense, hard, non-porous films and superior optical coatings for university, industrial and governmental R&D applications are within reach. The CE marked design with **Positive Kick™** is available in single or dual module configurations in a 2U rack. The patent-pending IMPULSE® technology is ideal for reactive sputtering, synchronized co-sputtering and substrate-timed pulse biasing. The ultra-fast IMPULSE® topology also enables extremely short pulses (<25µs) for high sp^3 at-C and smooth films. Combined with the **Positive Kick™** a wide range of dielectrics and metal layers can be deposited on low-temperature substrates including preferred-orientation epitaxial growth.

FLEXIBLE, SCALABLE PULSE TOPOLOGY

The IMPULSE® architecture allows for sequential and parallel combination pulse firings to achieve the optimal operating environment for your application. Easily sputtered metals, like Cu and Al, draw high peak currents at lower repetition rate. More challenging metals or dielectrics, like C and GaN, can be managed at high-repetition rate with lower peak currents. Multiplexed higher frequency and power configurations are available, i.e. IMPULSE® 20-20 x N units.

BIAS & SYNCHRONIZATION

The user-adjustable **Positive Kick™** pulse engages after the main negative pulse to enhance ion transport to the substrate, increase deposition rate, tailor film stress, perform in-situ etching & cleaning, and clear charge on surfaces for reactive applications—broadening the process envelope. Users can set kick amplitude, delay, and duration to manage adatom mobility, film nucleation and tensile-to-compressive stress conditions. Synchronization and substrate bias timing allows selection of which ions will implant in the film densification phase—allowing users to tailor the ion energy for metal or dielectric implantation while minimizing carrier gas ion effects. Multiple IMPULSE® modules synchronize for cluster tool operation with local or remote control.

- ⇒ Pulsed power add-on module for your existing DC power supply
- ⇒ Flexible pulse topology allows for up to **4kHz** repetition rate or **400A** peak currents for a range of targets
- ⇒ **Positive Kick™** for higher ion fraction % and increased deposition rate vs. traditional HiPIMS
- ⇒ Great for reactive applications
- ⇒ Remote operation capability

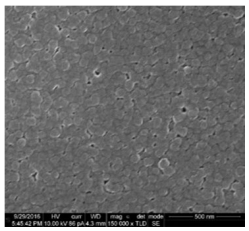
IMPULSE® 2-2 Dual Pulsed Power Module

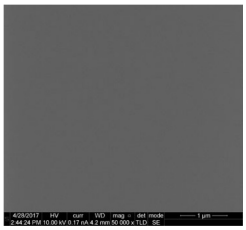
IMPULSE® 2-2 Pulsed Power Module

Applications

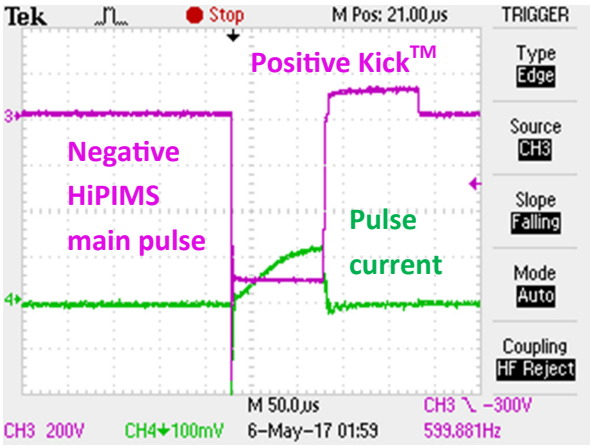
⇒ Dense, Hard Films
⇒ Non-Porous Films
⇒ Superior Optical Coatings
⇒ Superconductors
⇒ Multilayer Films

For Linear & Cylindrical Cathodes





Carbon deposition comparison of conventional DC sputtering (left) with the smooth, hard, non-porous film with high sp^3 provided by HiPIMS (right)



IMPULSE® 2-2 I-V Waveform

Physical and Performance Specifications

Parameter	Base Model SF-IMPULSE2GX-SH-SE (single) SF-IMPULSE2GX-DH –SE(dual)	Advanced Kick Model SF-IMPULSE2KX-SH-SE (single) SF-IMPULSE2KX-DH-SE (dual)
Input Power Specifications	1 Phase, 100-240 VAC, 50/60 Hz, 2.5 A per module	
Input Charging Supply	-1000 VDC nominal, -1250 VDC tolerant	
Time-Average Power	Up to 2 kW; subject to duty factor and rep rate	
Output Peak Voltage	-1000 V nominal, -1250 V tolerant	
Output Peak Current	200 A nominal, 400 A tolerant	
Arc Detection Time	< 200 ns	
Arc Arrest Time	< 500 ns	
Over Current Response Time	< 2 µs	
Peak Current Limiter	User adjustable up to 400 A in high current operation, up to 200 A in high frequency operation	
Power Limit Mode	User selectable up to 2 kW	
Pulse Frequency	User selectable; 1 Hz to 2 kHz (high current mode) or 4 kHz (high frequency mode) nominal range, subject to power derating curve	
Pulse Width	Highly selectable for end-use application; 2 µs to >1000 µs nominal range	
Quench Pulse Set Points	On/Off; User selectable in 1 µs increments for pulse width	N/A
Kick Pulse Set Points	N/A	On/Off; User selectable in 1 µs increments for pulse width
External Communications	RJ-45 Ethernet control I/O, USB Type A, BNC sync line, BNC I-V monitor out, RS-422 serial	
Pulse Module Sync	< 0.1 µs latency	
Cathode Cabling	N-type HV connector standard	
Configuration Storage	Onboard storage for 20 user selectable presets	
Physical Dimensions	2U rack; 19" (W) x 3.5" (H) x 22.5"(L) including handles and plugins 482.6mm (W) x 88.9mm (H) x 571.5mm (L) including handles and plugins	
Weight	Single module: 26 lbs, 1.8 oz. (11.84 kg) Dual Module: 30 lbs, 3.0 oz (13.69 kg)	Single module: 26 lbs, 14.8 oz. (12.21kg) Dual Module: 31 lbs, 13.0 oz (14.43 kg)
Operating Temperature	+5C to +40C, forced air cooling	

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