



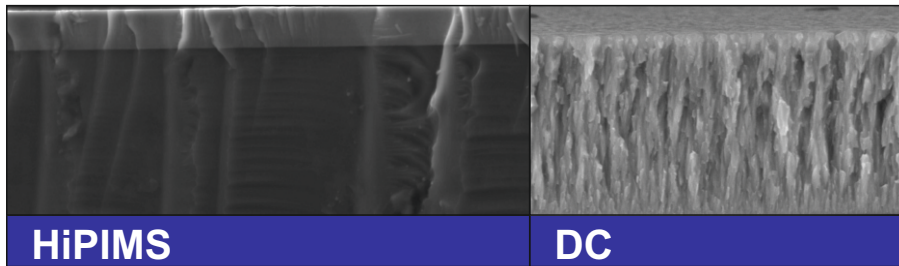
## VIBRANT TECHNOLOGY by MELEC GmbH

Superposition Technology  
HiPIMS combined with DC or Mid. Frequency



**DC Pulse Power Controller SPIK3000A**  
**Industrial scale**  
**5kW - 90kW DC AVERAGE POWER**

• HiPIMS • Mid.-Frequency (MF) • DC



### Improvements of coating using HiPIMS

- Higher ion bombardment
- Better coating adhesion
- Harder coating
- Denser films

### Superimposed Processes for higher deposition rate

- HiPIMS + DC
- HiPIMS + MF

### Motivation for HiPIMS acceptance in the industry

- Highest depositionrate → HiPIMS in combination with DC or Mid-Frequency, 4-5 times higher
- Reducing / preventing of arcing / poisoning → HiPIMS used in pulse package mode
- Highest process stability tuning; reproduceable → HiPIMS/MF used in bipolar pulse mode
- Low cost retrofit applications, single magnetron → Use of your existing DC power supply combined with HiPIMS

### Visit us on Exhibition:



**ICMCTF 2019**  
**San Diego, CA, USA**  
**19 - 24 May 2019**  
**Booth# 321**



**E-MRS 2019**  
**Nice, France**  
**27 - 31 May 2019**  
**Booth# 73**

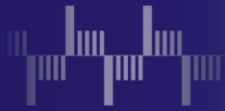


**HiPIMS 2019**  
**Braunschweig, Germany**  
**19 - 20 June 2019**  
**Booth# 1**



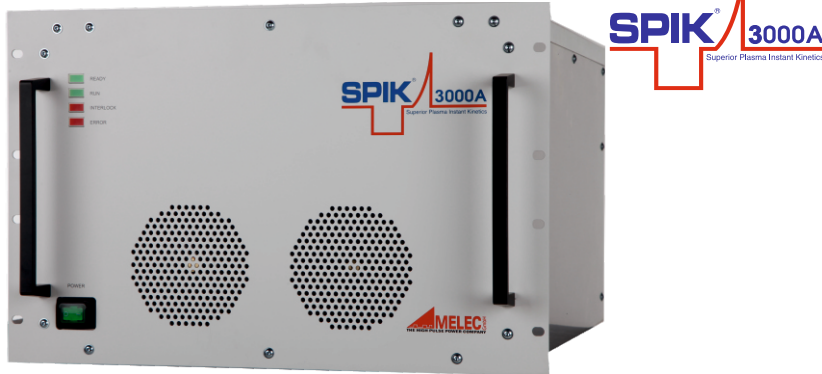
**V2019**  
**Dresden, Germany**  
**8 - 10 October 2019**  
**Booth# not yet known**





## DC Pulse Power Controller and DC Power Supplies

### PULSE POWER CONTROLLER SPIK3000A



• HiPIMS • Mid.-Frequency (MF) • DC

Type	SPIK3000A-10	SPIK3000A-20	SPIK3000A-30
Average Power	10 kW	20 kW	30 kW
Pulse Output Power	+/- 1000 kW (peak)		
Pulse Output Voltage	+/- 1000 V (max.)		
Pulse Output Current	+/- 1000 A (max.) ≤ 2 kHz		
	+/- 500 A (max.) ≤ 12,5 kHz		
	+/- 150 A (max.) ≤ 25 kHz		

Type	SPIK3000A-EF-05
Average Power	5 kW
Pulse Output Power	+/- 500 kW (peak)
Pulse Output Voltage	+/- 1000 V (max.)
Pulse Output Current	+/- 500 A (max.) ≤ 2 kHz
	+/- 250 A (max.) ≤ 12,5 kHz
	+/- 150 A (max.) ≤ 25 kHz
	+/- 75 A (max.) ≤ 50 kHz

### Diode Module



Type	DM-500-WC	DM-1000-WC
VRRM* <sup>1</sup>	1000 V	
IF* <sup>2</sup>	500 A	1000 A
VIN, max	1000 V	
Pin, max* <sup>3</sup>	30 kW	

1 - VRRM - Repetitive peak reverse voltage  
 2 - IF - Forward current (per arm)  
 3 - Pin - max. input power combined

### ADL Power Supplies GS 05 - GS 30



0,5 kW - 3 kW  
max. 1000 V

### ADL Power Supplies GX 50 - GX 150



5 kW - 15 kW  
max. 1000 V

### ADL Power Supplies HX 150 - HX 350



15 kW - 30 kW  
max. 1000 V





# Superimposed HiPIMS applications

Electric Circuit  
Superimposed HiPIMS / DC  
using Single Magnetron

Figure 1

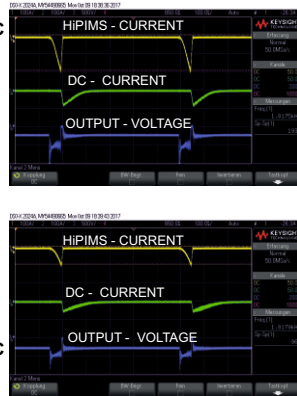
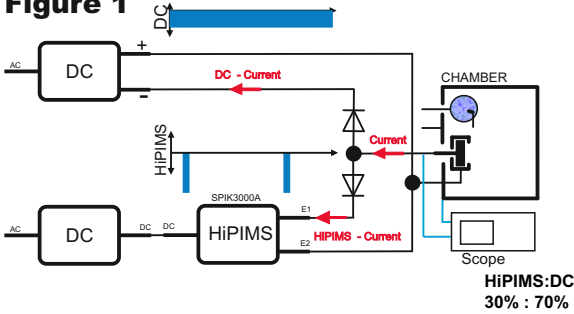


Figure 1

The basic electric circuit shows the different paths of DC-current and HiPIMS-current depending on the different voltage levels (DC = constant; HiPIMS = f(t)). The gate-way of the two diodes is synchronized automatically by themselves because of the condition:

$$DC-V < HiPIMS-V f(t)$$

HiPIMS combined with DC generates in the NON REACTIVE SPUTTERING MODE highest depositions rates

Electric Circuit  
Superimposed HiPIMS (UP) / MF  
using Single Magnetron

Figure 2

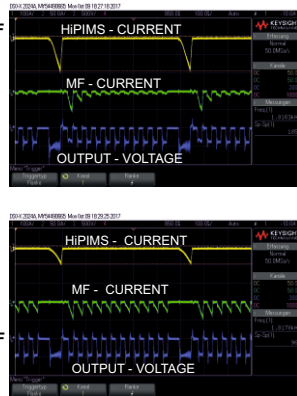
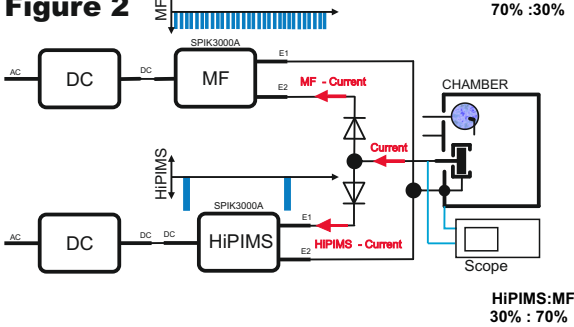


Figure 2

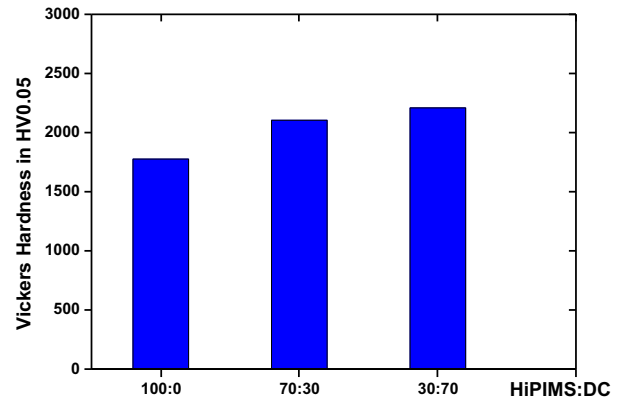
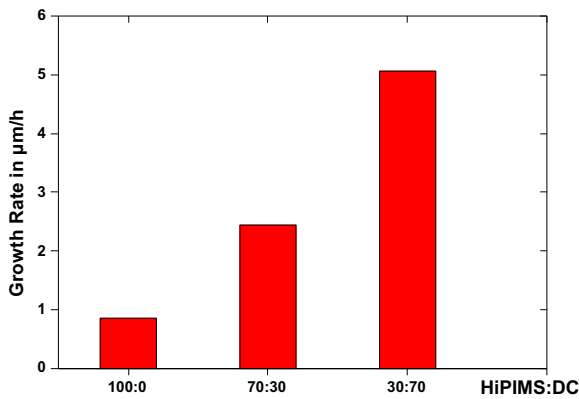
The basic electric circuit shows the different ways of Mid.Freq.-current and HiPIMS-current depending on the different voltage levels (Mid.-Freq.-voltage = f(t); HiPIMS-voltage = f(t)).

The gate-way of the two diodes is synchronized automatically by themselves because of the condition:

$$Mid.-Freq.-V f(t) < HiPIMS-V f(t)$$

HiPIMS combined with Mid.-Freq. generates in the REACTIVE SPUTTERING MODE highest depositions rates, prevents arcing and poisoning.

# Ti-N Deposition Rate and Hardness



- HiPIMS+DC total power: 5 kW
- HiPIMS duty cycle 9.1%, Frequency 1818 Hz
- Ti target
- Working Gas: Ar(300 sccm) - N<sub>2</sub>(14 sccm)
- without Substrate Rotation

$$\Delta H = +/- (5-10)\%$$

Some projects and collaborations were supported by



Federal Ministry of Economics and Technology



Reference:



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