EMICON SA

PLASMA MONITOR AND
PROCESS CONTROL SYSTEM

STAND-ALONE PROCESS CONTROL SYSTEM FOR INDUSTRIAL PRODUCTION LINES

New in 2018:

- Recording of voltage and current curves in pulsed applications (e.g. HIPIMS, …)
- Advanced and combined sensor data evaluation and process control algorithms

Highlight Features:

- Full spectral data acquisition at up to 8 different machine location
- Input of up to 8 external sensors signals (e.g. lambda probe, target voltage, ...)
- 24/7 stand-alone operation by means of integrated processor unit
- Communication by industrial standard interfaces (LAN, Profibus/-net, DIOs, …)

Benefits:

- Comprehensive process monitoring and control in single tool
- Increase of product quality and yield by stabilizing production process
- Establishing and mastering next generation processes
- Easy installation or retrofitting in existing production lines

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Number of spectrometer channels	1 - 8
Spectral range	200 - 1100 nm (totally covered by each spectrometer)
Number of wavelength channels	unlimited (selected by software without hardware modification)
Spectral resolution	1.5 nm FWHM
Minimum time resolution	1 ms
Detector	CCD array with 16 Bit A/D converter
Optical fiber connector	SMA 905
Pulse curve inputs	2 (0-2 V / 0-4 V)
Sampling rate	40 MHz
Pulse trigger inputs	2 optical and 1 analog ± 5V
Monitor track types	spectral, external sensor, pulse form
Analysis of monitor tracks	absolute, combined (+,-, /,*), ratio, average, integral, …
Analog sensor inputs	2 (4, 8) x 0-10 volts (iCoupler)
Analog control outputs	4 (8) x 0-10 volts (iCoupler)
Digital outputs	8 (16) x TTL / 24V (Opto-Coupler)
Digital inputs	8 (16) x TTL / 24V (Opto-Coupler)
Remote control interfaces	LAN, Profibus, Profinet, DIOs, …
Processor unit	Integrated MPU with EMICON SA operating system
Display	5.7" color touch panel (resistive)
Power supply	24 VDC 2.5A
Housing	19" rack mount box (4U, 84HP)
Dimensions [mm]	480(w) x 190(h) x 420(d)
Weight [kg]	7.5

EMICON SA Manager software on Windows® 7 / 8 / 10

PLASUS EMICON SA Series

Data Sheet

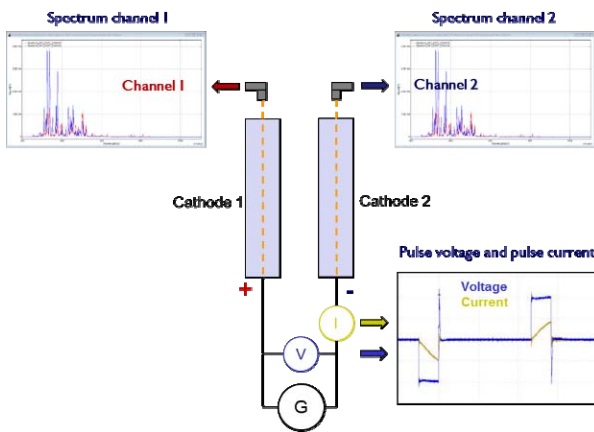|	EMICON 1 SA – 8 SA
Number of spectrometer channels	1 - 8
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Number of wavelength channels (monitor tracks)	unlimited (selected by software without hardware modification)
Analysis of monitor tracks	single, combined (+,-, /,*), ratio, average, integral
Spectral resolution	1.5 nm FWHM
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Detector	CCD array with 16 Bit A/D converter
Optical fiber connector	SMA 905
Analog inputs	2 (4, 8) x 0-10 volts (iCoupler)
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Digital outputs	8 (16) x TTL / 24V (Opto-Coupler)
Digital inputs	8 (16) x TTL / 24V (Opto-Coupler)
Remote control interfaces	LAN, digital inputs, (Profibus)
Processor unit	Integrated MPU with EMCON SA operation system
Display	5,7" color touch panel (resistive)
Power supply	5 VDC 4A
Housing	19" rack mount box (4U, 84HP)
Dimensions [mm]	480(w) x 190(h) x 420(d)
Weight [kg]	3.5
Remote administration	EMICON SA Manager software on Windows® 7/8/10
Typical applications	PECVD, (reactive) sputtering, etching, HIPIMS, ATM plasmas
Field of application	process control, QA/QC, endpoint detection, fault detection in production lines

Other options are available on request

Full control of reactive pulse and HIPIMS processes
PLASUS EMICON SA latest sensor development

In pulse and HIPIMS plasmas the degree of ionization is one main factor for layer density while layer stoichiometry is ruled by the plasma composition of metal and reactive gas species. Changing either parameter will affect also the other parameter. Thus controlling both, degree of ionization as well as stoichiometry simultaneously can only be realized by combining different measuring and controlling methods.
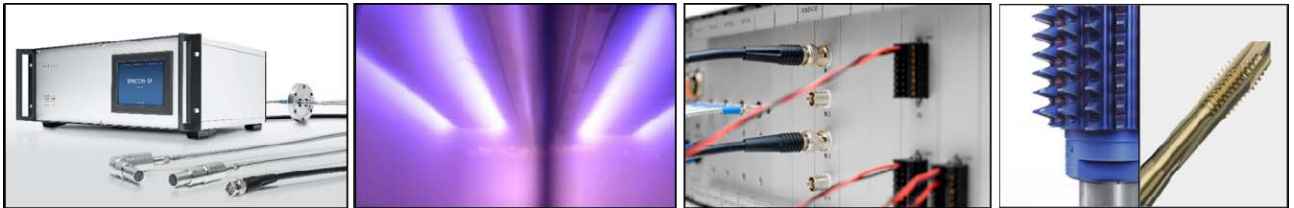
The new Pulse and HIPIMS sensor of the EMICON SA system records peak current and peak voltage and is combined with the spectroscopic plasma monitoring technique in a single system. All sensor signals are evaluated in a common control algorithm realizing reliable and stable process control of both plasma parameters.
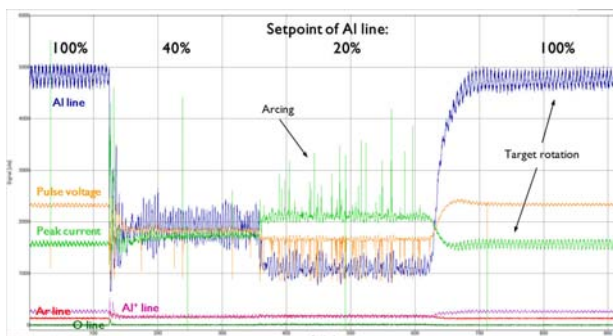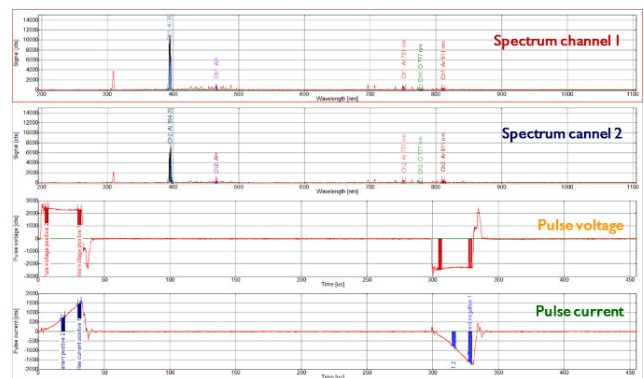

Sensor and measuring setup:
- Single or dual cathode application
- Full broadband spectral information of each cathode
- Pulse current and pulse voltage measurement
- Pulse triggered data acquisition

Signal selection:
- Multiple spectral lines
- Peak current and peak voltage
- Shape of current and voltage pulse
- Combined signals, e.g. + , - , / , *, ...

Process monitoring and control:
- Real-time monitoring of particle densities
- Recording of peak current and peak voltage
- Control of reactive gas flow
- Control of degree of ionization

P L A S U S
Spectroscopic plasma monitor and
process control systems

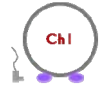# Examples & Applications
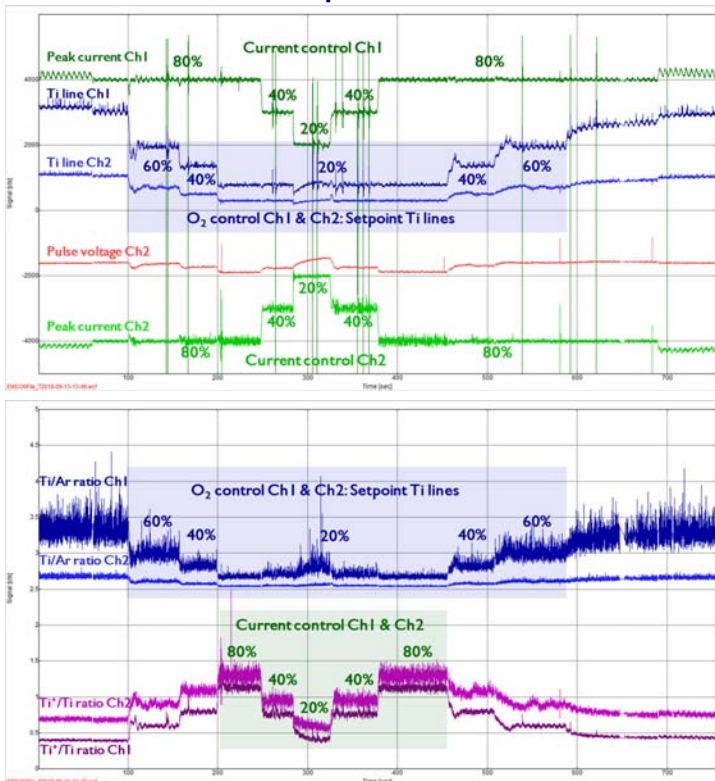
AlO reactive HIPIMS unipolar:
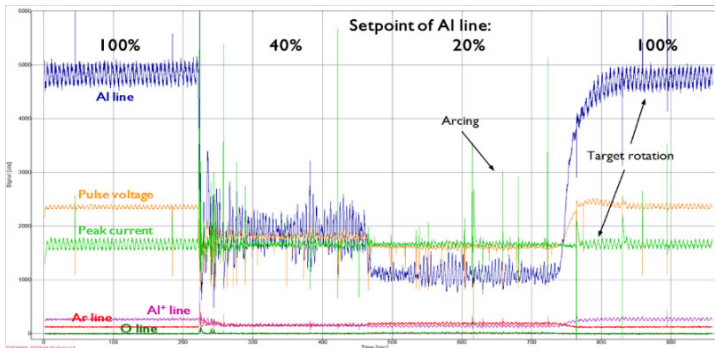
Application:
Control of oxygen flow with Al line
Control of pulse peak current using variable
pulse-off times

Features:
Stable gas flow control despite target rotation and arcing
Pulse peak current increases with reactive gas flow
Pulse voltage decreases with reactive gas flow

TiO reactive HIPIMS bipolar:

Application:
Control of oxygen flow with Ti line at both cathodes
independently
Control of pulse peak current at power supply
for both cathodes independently

Features:
Stable and equal gas flow current control at both
cathodes
Stable and equal pulse peak current control at both
cathodes
Gas flow control holds setpoint while varying peak
current at cathodes

Benefit:
Independent control of stoichiometry (reactive gas flow)
and ion density (peak current)
Balancing cathodes despite setup, target erosion, etc.
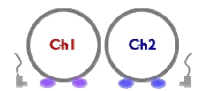
Perspectives for R&D and production

Combined real-time monitoring and controlling opens new opportunities for reactive high-density plasmas:
► Control of working points which could not be controlled so far
  (increased deposition rate, new or better layer properties, …)
► Stabilizing production process by combined control techniques and advanced pulse generators
  (setting of power, voltage, current, pulse on-time, pulse off-time, different settings for ±pulse in bipolar mode, …)
► Compensation of cathode gyration and erosion by in-situ change of magnetic configurations

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Cooperation of:

PLASUS — Spectroscopic plasma monitor and process control systems

IOT — Technische Universität Braunschweig Institute for Surface Technology

Fraunhofer IST

IFU Diagnostic Systems GmbH