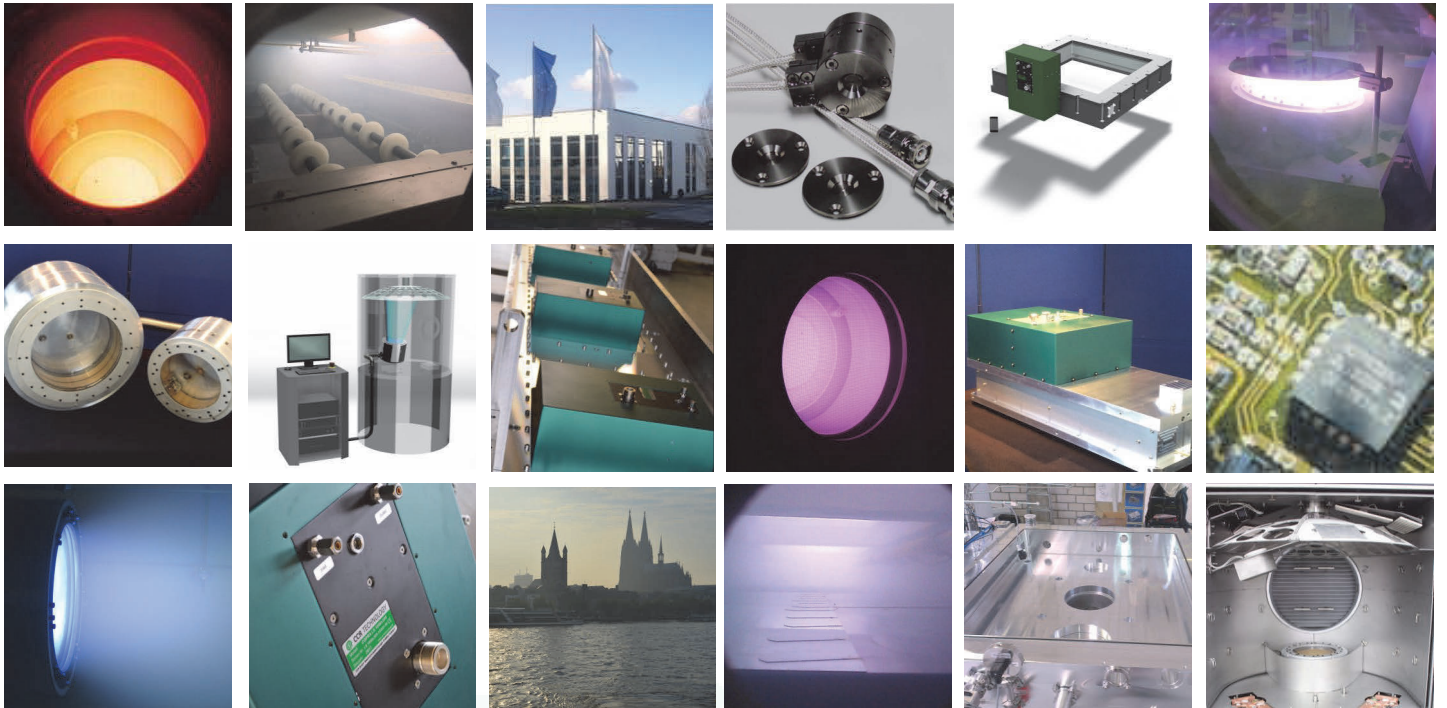


CCR Technology

COPRA® RF-ICP-Plasma Solutions

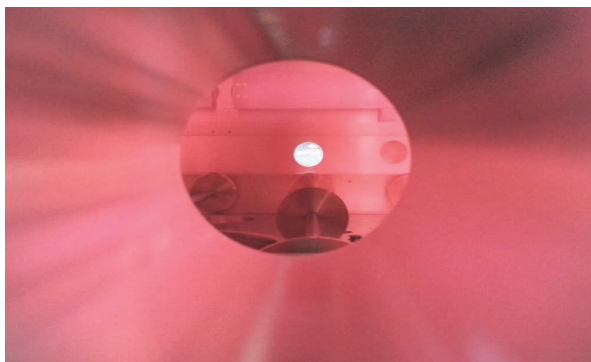
PECVD- PVD Assist- Etching- Cleaning- Activation- PALD Assist



Welcome at CCR Technology

Together with our Customers we are strong!

When we founded CCR Technology in the year 1995 and started to develop RF - Plasma Technology we never thought that we would be facing the beginning of such a success story. We just followed up some technical ideas and wanted to add our simple contribution to the industrial plasma community, but today we know that we added a major contribution, probably the most efficient, flexible and reliable currently existing plasma technology in the market. Nearly 700 units in more than 40 countries in the world have been sold in major markets like solar, precision optics, storage media, semiconductor or hard and decorative coatings. But not the COPRA alone caused this success. It only worked together with our company philosophy. We believe in the ethics as a gap in the market and treating our customer as partners with open access to our knowhow pool, motivated by the fact that only customer's success is our success prove us right. That is the way we think to operate successfully in innovative markets where rapid success is demanded in order to gain the financial resources to create front end technology. We are now working in the field of plasma since 25 years and see our jobs as a gift when we are talking to our customers and help setting the course for the development of future technology.



CCR's Headquarter , Troisdorf, Germany

About CCR's Business

CCR Technology is the inventor of the *COPRA Plasma Technology*® and serves the supply chain of end user, original equipment manufacturers and research groups in markets like optics, solar, semiconductor, wear & decorative coatings as well as storage and display media. The business of CCR is all around COPRA Plasma Sources based on a unique 13.56 MHz plasma excitation method which is superior due to its power efficiency, scalability and its reliability. Target applications are plasma enhanced chemical vapor deposition "PECVD" of silicon, metal oxides and nitrides for barrier & functional layers, for optical filter stacks as for protective and wear& decorative coatings, as well as the assistance of PVD Processes as f.e. Sputter Assist or E-Gun Assist.

The COPRA Plasma Technology®

The COPRA Plasma Technology is based on inductively coupled 13.56 MHz plasma excitation and its unique feature is the high degree of plasma excitation efficiency in combination with scalability from R&D to the appropriate of industrial production scale. The COPRA Technology® unrivaled characteristics allows one to work with unchanging basic plasma parameters. This means that your process result will not be negatively affected by scaling in size and speed.

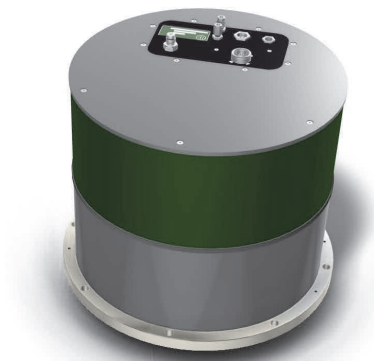
CCR's Markets

Precision Optics	Optical Multilayer, Sputter & E-Gun Assist
Solar	AR, Passivation, Absorber, Barrier Layers
Displays	OLED Encapsulation, TCO Coatings, Transparent Hard Overcoating
Storage Media	TMR barriers, Carbon Overcoats
Semiconductor	Chemical Etching & Physical Etching
Large Area	Functional Metaloxide Layers, Barrier Layers
Hard & Decorative Coatings	DLC, Oxide and Nitrides Coatings
Packaging	Roll-to-Roll Barrier Layers via PECVD

COPRA Product Family!

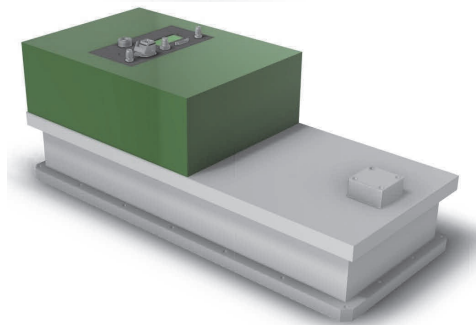
COPRA Round Sources

- Wafer processing up to 12" substrates
- Plasma Assist in PVD Coaters
- Plasma Activation & Cleaning
- Plasma Assisted ALD



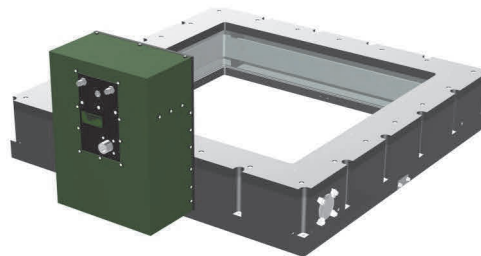
COPRA Linear Sources

- Roll-To-Roll „Web" Processing
- PECVD on Flexible Substrates
- PVD Assist & PECVD in Batch processing
- PVD/PECVD Hybrid Batch+Inline processing



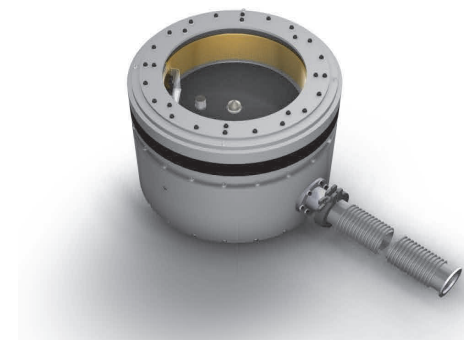
COPRA Rectangular Sources

- Flat Panel PECVD up to Generation 5
- PECVD on Large Substrates
- PVD Assist & PECVD Batch + Inline processing



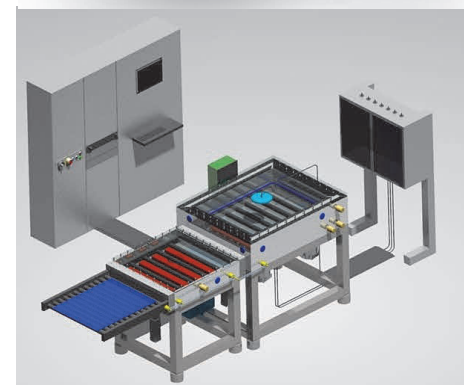
COPRA Built In Sources

- PVD-Assist in E-Gun Coaters
- „Web" Processing
- DLC deposition in E-Gun Coaters



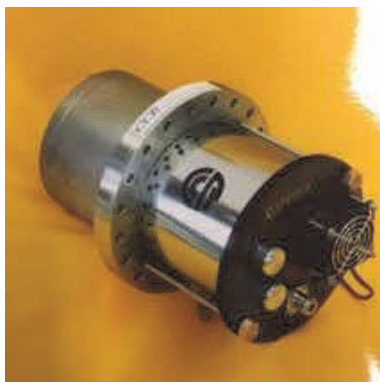
COPRA Plasma Systems

- InLine or Batch
- PECVD coaters for metaloxide/nitride functional coatings
- R&D Coaters



developing tomorrow's surface®

Advantages of using COPRA Plasma Technology ®



1st CCR COPRA Prototype in 1997



Part of the typical COPRA Matchbox design

Advantages of using COPRA Plasma Technology®

What makes the COPRA Technology unique?

The COPRA RF-ICP-Plasma Technology is an worldwide patented Plasma Excitation Solution and can be used for a wide range of industrial processes and applications. The COPRA Source has been developed to provide high-end industrial process solutions paired with a maximum of efficiency. Every COPRA Plasma Source which leaves the production area in Germany equipped with the COPRA Plasma Technology® represents a perfectly tailored solution for the requested needs of our customers.

Technical-/Process benefits:

- Industrial proven
- High efficiency with nearly 90% dissociation
- Low Ion Energy operation capability
- Wide Pressure Range 1×10^{-4} – 1×10^{-1}
- No filament, quasi neutral beam
- Operation with nearly any & pure gas
- Integrated matchbox
- Ion Current density control independent from Ion Energy
- High amount of O+
- Long term Process stability
- Low contamination level
- Surface activation within seconds
- Wide processing window

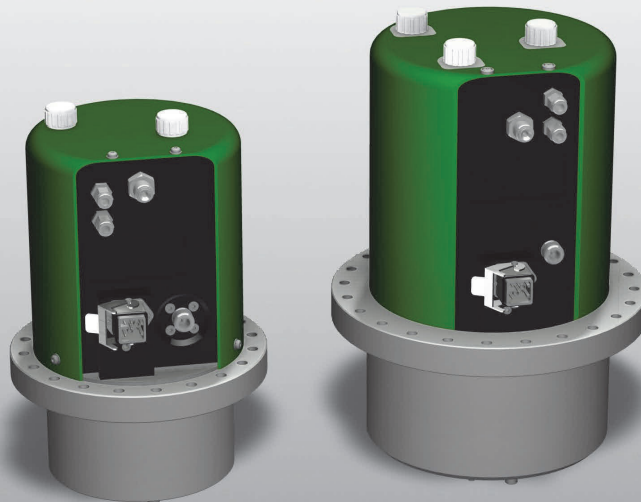
Mechanical benefits:

- Scalable to custom size
- Integrated matchbox
- Easy to service

economical benefits:

- Low operating costs
- Low maintenance costs
- Short down times
- Maintenance poor
- Lower energy consumption footprint





COPRA DN160-200 Plasma Beam Source for R&D



DN200 mounted on COPRA
CUBE R&D System



DN200 Plasma Beam inside the
COPRA CUBE

COPRA DN160–DN200

Plasma Beam Source for R&D

COPRA stands for „Controlled Plasma Reactor“ and represents an inductively coupled plasma source technology which can easily be scaled for industrial applications.

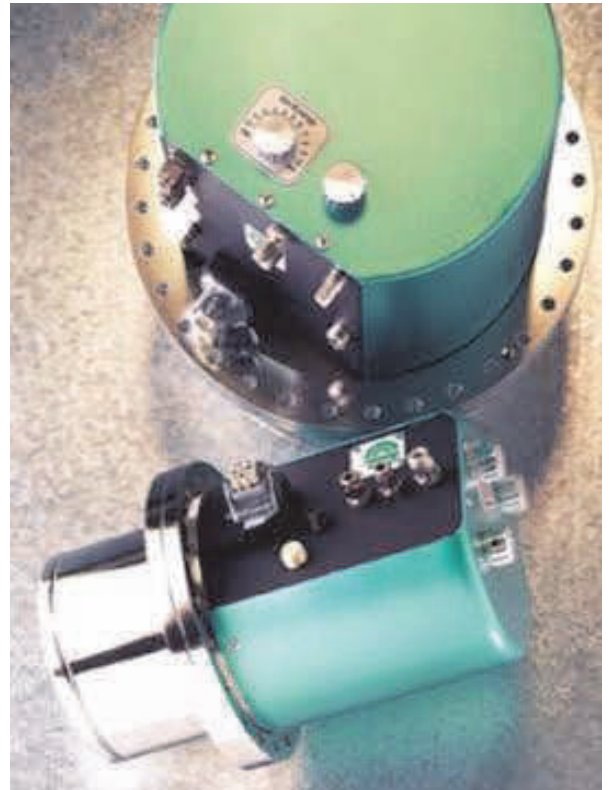
The COPRA DN160 and COPRA DN200 has been designed for Research and Development in the field of Plasma Surface Science. These are Manually matched Plasma Sources and are typically flange mounted by CF.

High plasma densities in combination with dissociation degrees of up to 90 % enable to drive fast PECVD processes as well as surface cleaning, oxidation, nitridation and activation processes.

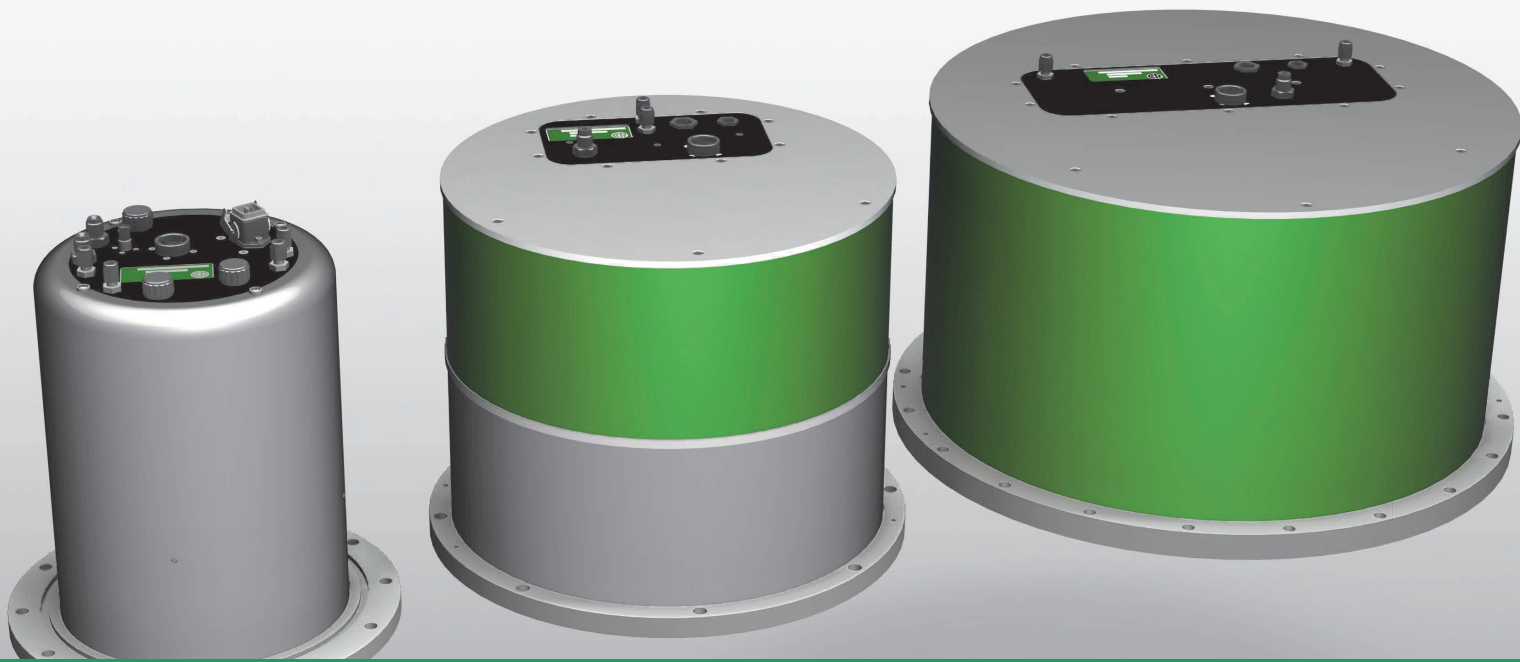
Results achieved by the COPRA DN160 and COPRA DN200 can be transferred to upscaled COPRA Plasma Sources and therefore a fast transfer to industrial production is enabled.

Main Applications:

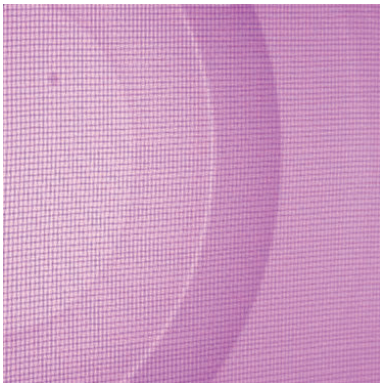
- R&D SetUp's
- PECVD
- Etching processes



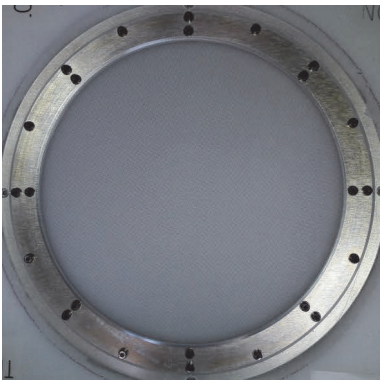
Technical Data	DN160 CF	DN 200 CF
Dimensions	Ø 203x280 mm	Ø 253x333 mm
Plasma Opening	Ø 84 mm	Ø 122 mm
Excitation Frequency	13,56 MHz	
Impedance Match	Manual Match	
RF – Power	600 W	
Ion Energy	30–250 eV	
Density @working distance	0,5–1,0 mA/cm ²	
RF – Connection	N-Type	
Water Connection	2x flex tube Serto 6 mm	
Water Flow	>2 l / min	
Operation Gas Pressure	1x10 ⁻⁴ to 1x10 ⁻² mbar	
Gas Connection	VCR 1/4	
Weight	approx. 20 kg	approx. 25 kg
Flange/ Body	CF/ VA	



COPRA DN250—DN401-DN501 for Wafer Processing up to 12"



DN250 CF high dissociated
Plasma Beam



COPRA DN401 completely
mounted Extraction Grid

COPRA DN250-401-501

For Wafer processing up to 12"

The DN 250-401-501 Series enables to process wafer-sized substrates. The precise control of the Ion Energy at different power levels coupled with state of the art Ion Current Density enable intelligent control of process related energies.

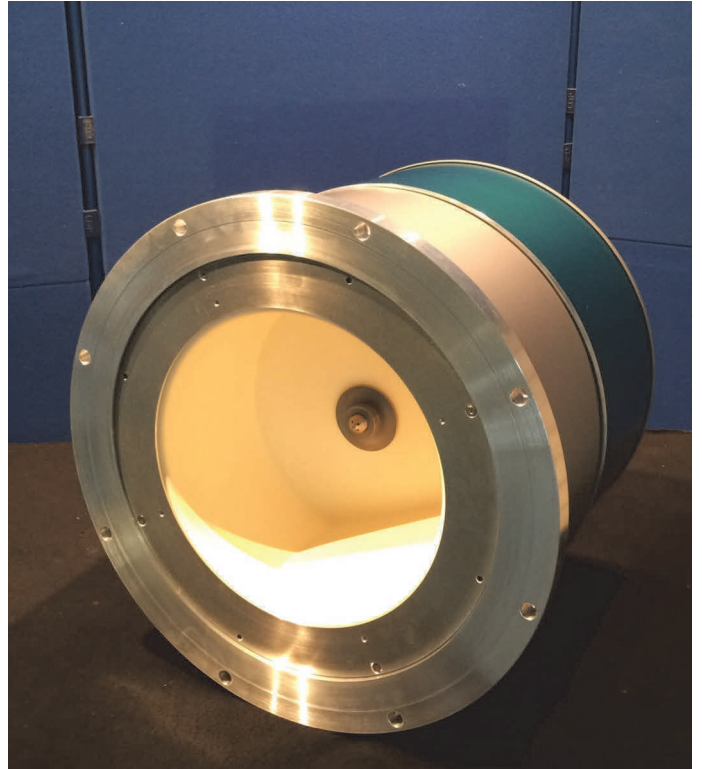
The customizable design of these sources facilitate particle poor thermal stable and stress free etching and deposition.

The COPRA DN Source-Series are key components in wafer-sized semiconductor or precision optic productions.

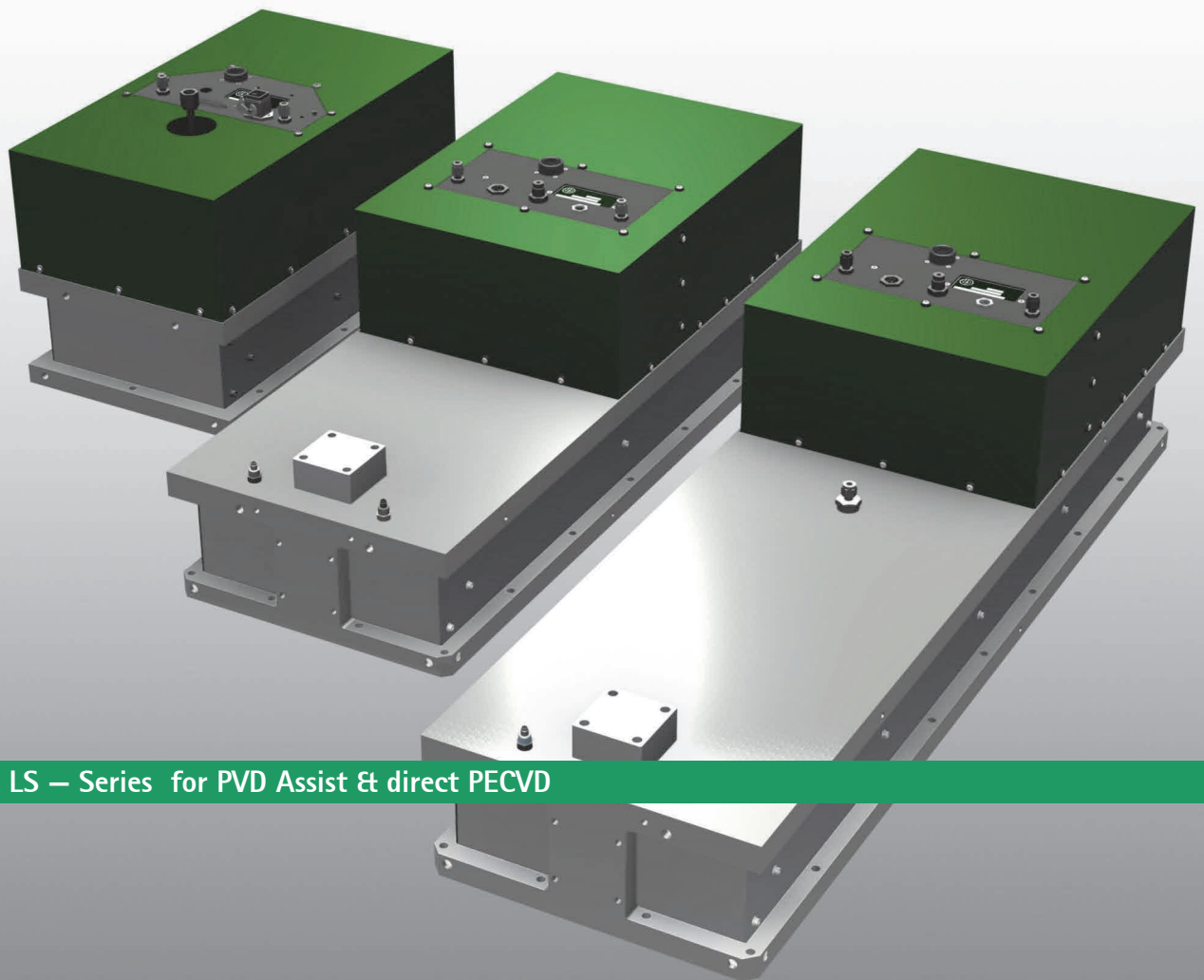
The DN- Source Series are easily scalable to serve customized dimensional needs.

Main Applications:

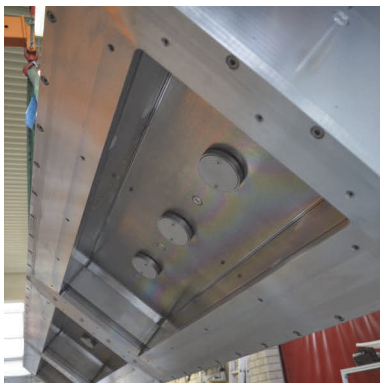
- Reactive Ion Etching
- Physical Etching
- Post Oxidation of thin film metal layers (Meta - Mode)
- ALD enhancement



Technical Data	DN250 CF	DN 250 – ISO-3 kW	DN 401	DN 501
Dimensions	Ø 304x400 mm	Ø 335x345 mm	Ø 430x340 mm	Ø 590x330 mm
Plasma Opening	Ø 162 mm	Ø 160 mm	Ø 244 mm	Ø 380 mm
Excitation Frequency	13,56 MHz			
Impedance Match	Manual/Remote	Manual/Remote	Integrated Remote Match	
RF – Power	1.800 W	3.000 W	5.000 W	5.000 W
Ion Energy	30–350 eV	30–350 eV	30–350 eV	30–300 eV
Density @ working distance	0,5–2,5 mA/cm ²	0,5–2,5 mA/cm ²	0,5–2,5 mA/cm ²	0,5–2,5 mA/cm ²
Energy Variation (optional)	Yes	Yes	Yes	Yes
RF – Connection	N	HN	HN	HN
Interface	Profibus/ Serial			
Water Connection	2x flex tube 6 mm		2x flex tube 8 mm	
Water Flow	>2 l / min			
Operation Gas Pressure	1x10 ⁻⁴ to 1x10 ⁻² mbar			
Gas Connection	VCR 1/4			
Weight	approx.25 kg	approx.35 kg	approx.40 kg	approx.45 kg
Flange/ Body	CF/ VA	ISO/ VA	CF/ AL	CF/ AL



COPRA LS — Series for PVD Assist & direct PECVD



COPRA LS-Large Area PECVD Design
with 3 Gasinlets per source



Large Area dynamic PECVD
deposition

COPRA LS—Series

For PVD-Assist & direct PECVD

The COPRA LS Sources Series are PVD-Assist and direct PECVD plasma sources for box & inline coater setup's.

Different configuration types enable adequate choice of gas types, appropriate PVD Assist functions and-/or direct PECVD deposition.

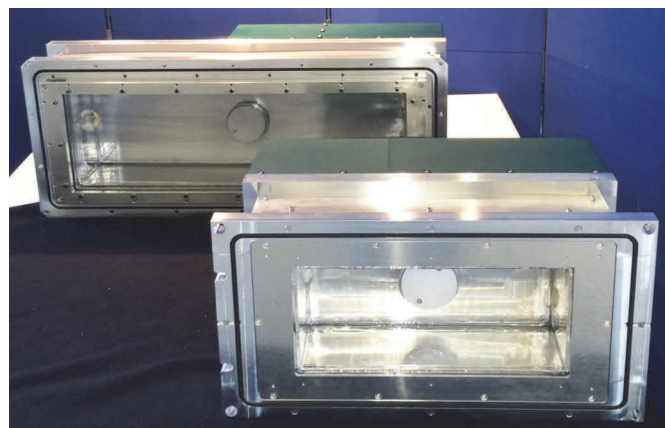
Due to their excellent homogenous distribution of the Ion current densities these sources are Large Area reactive etching capable.

The LS-Source Series can work with all types of gases and reach dissociation degrees of up to 90% with plasma densities $>1 \times 10^{-12} \text{ cm}^3$

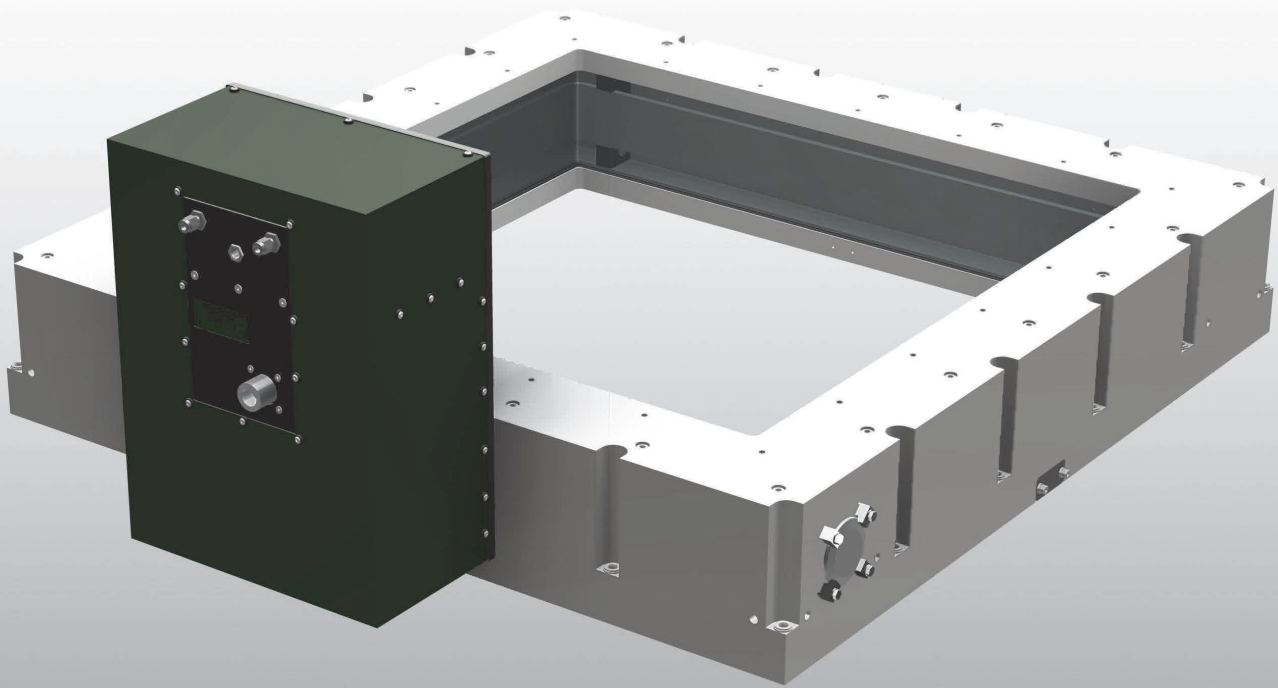
The LS- Source Series are easily scalable to serve customized dimensional needs.

Main Applications:

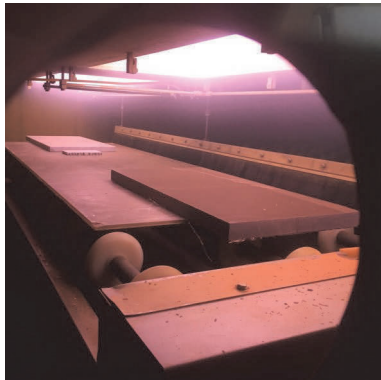
- PVD Assist and PECVD in both batch and Inline coater configurations
- Dynamic Etching
- Direct PECVD



Technical Data	LS358x156	LS670x201	LS950x201	LS – customizable
Dimensions	570x300 mm	842x346 mm	1122x346 mm	custom size
Plasma Opening	358x156 mm	670x200 mm	950x200 mm	custom size
Excitation Frequency	13,56 MHz			
Impedance Match	Integrated Remote Match			
RF – Power	5.000 W	5.000 W	5.000–10.000 W	5.000–10.000 W
Ion Energy	10–130 eV	10–130 eV	10–120 eV	10–130 eV
Density @ working distance	0,5–4 mA/cm ²	0,5–4 mA/cm ²	0,5–4 mA/cm ²	0,5–4 mA/cm ²
RF – Connection	7/16	7/16	7/16 or LC	7/16 or LC
Interface	Profibus/ Serial			
Water Connection	Serto 6 mm or 8 mm			
Water Flow	>3 l/min			
Operation Gas Pressure	5×10^{-4} to 1×10^{-2} mbar			
Gas Connection	Swagelok 6 mm or VCR 1/4			
Weight	approx. 75 kg	approx. 95 kg	approx. 110 kg	Custom size
Flange/ Body	AL	AL	AL	AL



COPRA RS — Series for Large Area PECVD



Large Area atomic Nitrogen Plasma of RS-PECVD COPRA Source



Dynamic PECVD on Large Area Substrates of 3.1x6.1m

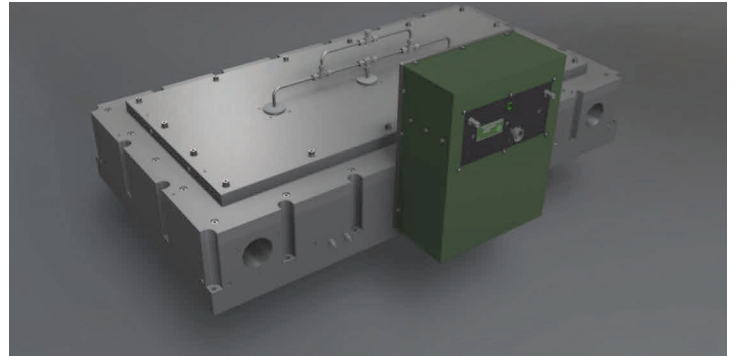
COPRA RS—Series

For Large Area PECVD

Large Area PECVD high throughput source solutions for industrial coating markets. The COPRA RS-Series robust design is industrial proven and due to it's lowest maintenance costs in particular suited for longer coating campaigns.

The RS- Source Series are scalable to serve customized dimensional needs.

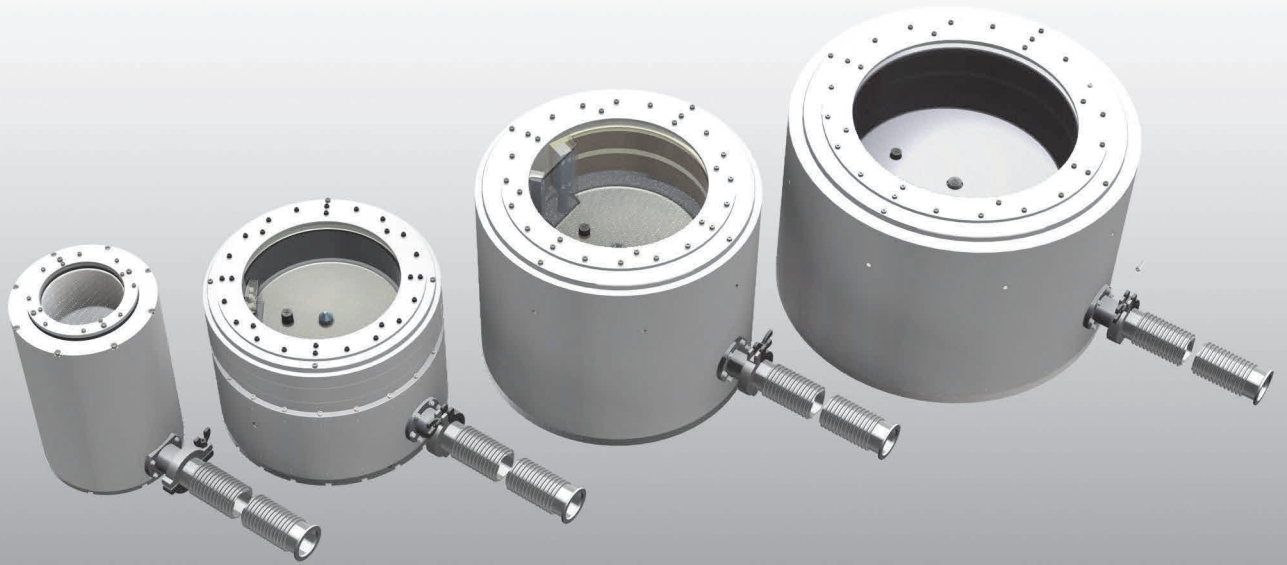
The RS- Design paired with the unique features of the COPRA Plasma Technology can cover substrate widths of more than 3 meter by mounting several RS-Sources InLine one beside the other.



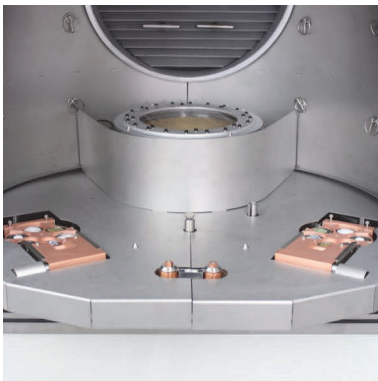
Main Applications:

- PECVD
- Large Area PECVD up to Gen.5
- OLED-Encapsulation
- Large Area Plasma Activation

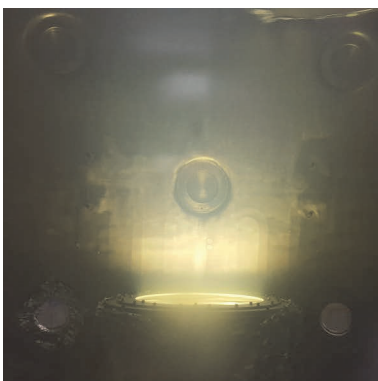
Technical Data	RS1000x400	RS1000x300	RS850x850	RS - customizable
Dimensions	1125x525 mm	1125x425 mm	975x975 mm	custom size
Plasma Opening	100x400 mm	1000x300 mm	850x850 mm	custom size
Excitation Frequency	13,56 MHz			
Impedance Match	Integrated Remote Match			
RF - Power	5.000 - 10.000 W	5.000 - 10.000 W	10.000 - 15.000 W	5.000 - 15.000 W
Ion Energy	10-50 eV	10-50 eV	10-50 eV	10-50 eV
Density @ working distance	0,5-1 mA/cm ²	0,5-1 mA/cm ²	0,5-1 mA/cm ²	0,5-1 mA/cm ²
RF - Connection	7/16 or LC	7/16 or LC	LC	7/16 or LC
Interface	Profibus/ Serial			
Water Connection	Serto 6 mm or 8 mm			
Water Flow	> 3,5 l /min			
Operation Gas Pressure	5x10 ⁻⁴ to 1x10 ⁻² mbar			
Gas Connection	Swagelok 6 mm or VCR 1/4			
Weight	approx. 250 kg	approx. 245 kg	approx. 245 kg	Custom size
Flange/ Body	AL	AL	AL	AL



COPRA IS – Series for E-Gun Assist & direct DLC



IS-301 placed in an E-Gun Coater for Precision Optics



Plasma Beam of COPRA IS400 assisting during E-Gun Process

COPRA IS—Series

For E-Gun Assist & direct DLC

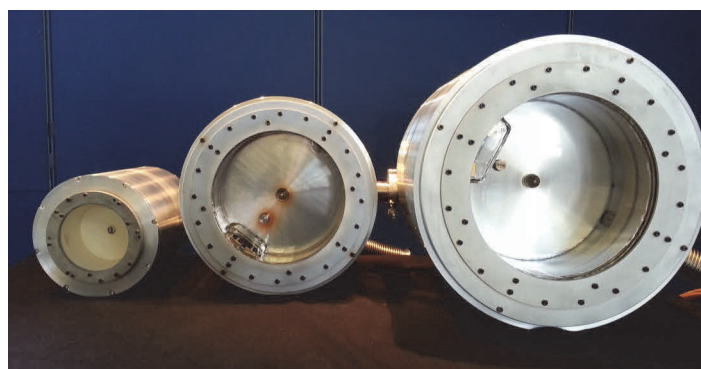
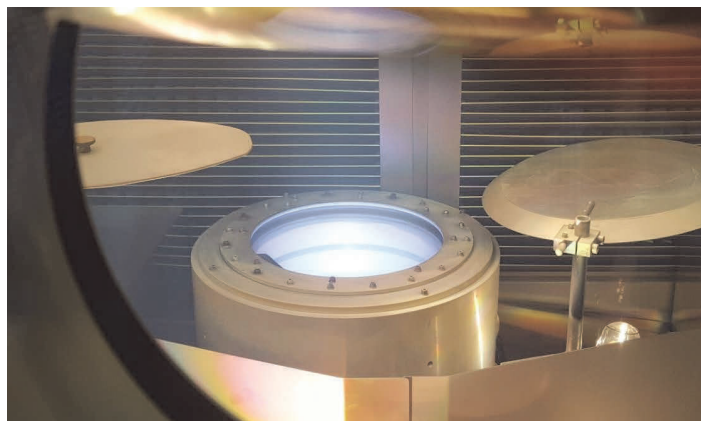
The IS Series have been developed for the precision optical coating segment. The special design allows you to place the source fully in the vacuum chamber and enables state of the art low energy Ion Assisted Deposition (IBAD) by using one source for calotte-/ or dome sizes of up to 2 meter.

These E-Gun assisting source types can run with pure gases and drive down significantly your maintenance costs.

The IS Series are hybrid PVD/PECVD capable. This means you can run the PVD Assist and the PECVD with the same source as f.e. DLC Coatings for Optics.

Main Applications:

- E-Gun Assist up to 2.0m Calotte-/Dome Size
- Direct DLC
- Web-Coating Assist



Technical Data	IS 200	IS 301	IS 400	IS 501
Dimensions	Ø 200x300 mm	Ø 330x255 mm	Ø 400x342 mm	Ø 500x340 mm
Plasma Opening	Ø 110 mm	Ø 220 mm	Ø 250 mm	Ø 320 mm
Excitation Frequency	13,56 MHz			
Impedance Match	Integrated Remote Match			
RF - Power	1.200 W	3.000 W	5.000 W	5.000 W
Ion Energy	40-350 eV	40-300 eV	40-400 eV	40-300 eV
Density at working distance	0,5-1,0 mA/cm ²	0,5-1,0 mA/cm ²	0,5-2,5 mA/cm ²	0,5-2,5 mA/cm ²
Energy Variation	Yes	Yes	Yes	Yes
RF - Connection	N	HN	HN	HN
Interface	Profibus/ Serial			
Water Connection	2x flex tube 6 mm		2x flex tube 8 mm	
Water Flow	>2 l / min			
Operation Gas Pressure	1x10 ⁻⁴ to 1x10 ⁻² mbar			
Gas Connection	Swagelok 4 mm			
Weight	approx.25 kg	approx.35 kg	approx.40 kg	approx.45 kg
Calotte-/Dome Size	550-760 mm	760-1100 mm	1100-1500 mm	1500-1950 mm

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The COPRA technology is patent protected!

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