

COPRA PLASMA TECHNOLOGY

OVERVIEW

Inductively Coupled Plasma Sources



COPRA PLASMA TECHNOLOGY

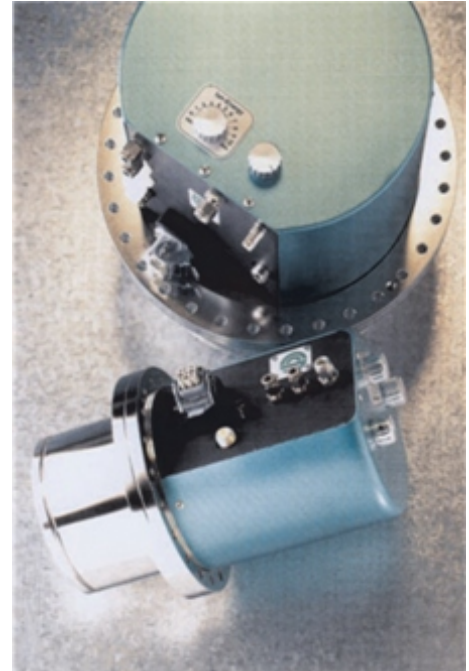
ICP-Plasma Source

1

The Copra Plasma Technology

COPRA is a versatile patented plasma source technology which can be used for various applications in particular for thin film PECVD. Due to the high plasma densities in combination with dissociation degrees of up to 90% the COPRA allows you to drive fast PECVD processes as well as substrate cleaning processes by protecting the substrate bulk against heat damage. The COPRA Technology enables high rate plasma enhanced chemical vapor deposition of amorphous silicon and microcrystalline silicon as well as SiO_2 , Si_3N_4 and TCO coatings.

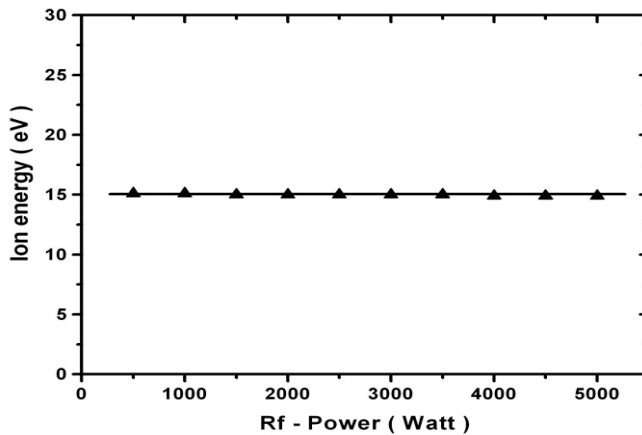
The beam produced by the COPRA plasma beam source is quasi-neutral i.e. it contains an equivalent number of ions and electrons permitting deposition, etching and surface modification of both conducting and insulating materials without charge build-up.



Characteristics

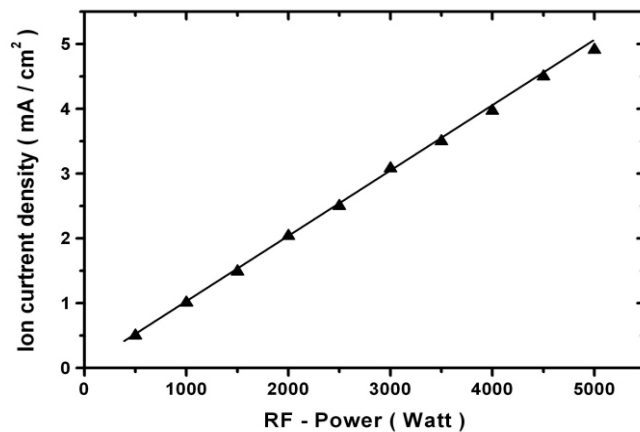
Power:	13.56 MHz RF, 0.1 to 5 kW, Depending on Size
Matching:	Integrated Matchbox, manually or remotely operated,
Gas Pressure:	1E-4 mbar to 1E-1 mbar
Gas:	Almost any including Metal Organic Liquids
Size:	Suitable for 84 mm up to 1200 mm substrate sizes
Ion Energy:	10 to 250 eV, $dE/E = \pm 5\%$
Ion Current Density:	0.05 to 1,8 mA/cm ²
Total Current:	Depends on Size
Plasma Density:	Up to 10 ¹² cm ⁻³
Ionization Degree:	Up to 50%
Dissociation Degree:	Up to 90%

Ion Energy vs. RF-Power



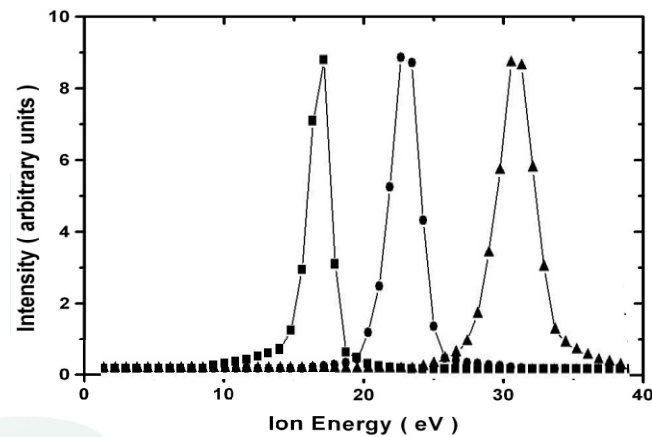
The COPRA Technology represents a "Purely"- inductively coupled plasma excitation with no rf biasing of the plasma sheath, i.e. no variation of the ion energy as a function of rf power.

Ion Current Density vs. RF-Power



High efficiencies by a linear increase of the ion current density as a function of rf power

Ion Energy Distribution



Low ion energies below the bulk displacement energy but above the surface binding energy enables efficient surface treatment and deposition at very low defect rates.

LARGE AREA PECVD

Deposition Rates

3

Silicon based

Amorphous hydrogenated Silicon - a-Si:H	10 nm per sec
Amorphous low hydrogenated Silicon - a-Si:H	5 nm per sec
Nano crystalline Silicon - nc-Si	3 nm per sec
Micro crystalline Silicon - μ c-Si	2 nm per sec
Silicon Nitride - Si_3N_4	5 nm per sec
Silicon Oxide SiO_2	5 nm per sec

Carbon based

Highly tetrahedral amorphous Carbon - ta-C:H	3 nm per sec
Carbon Nitride - C_xN_y	3 nm per sec
Diamond	1 nm per sec

Metal Oxides and Nitrides

Zink Oxide - ZNO (TCO)	3 nm per sec
Titanium Oxide - TiO_2	3 nm per sec
Aluminum Oxide - Al_2O_3	2 nm per sec

Examples of Film Properties

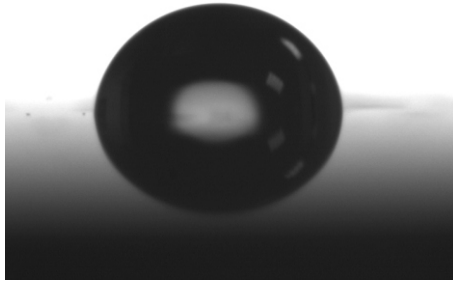
a-Si:H	Photo-/Dark Current Ratio	2×10^5
TCO of ZNO	Optical Transmission:	99 %
	Sheet Resistance:	10 ohm / sq (at 1 micron)
Al_2O_3	Optical Transmission:	99.8 %
	Hardness	24 GPa
TiO_2	Visible Transmission:	99.8 %
	Refractive Index	2.51

Example of Applications

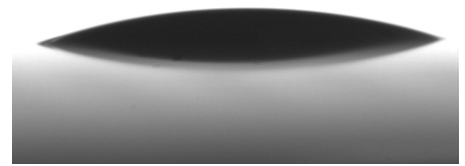
4

Substrate Cleaning

Oxygen Pretreatment of Polycarbonate (PC) Substrates



Before Treatment



After 10 sec Atomic Oxygen Treatment

Atomic Oxygen Beam at Ion Energies below 20 eV limits the temperature elevation at the substrate to below 70°C

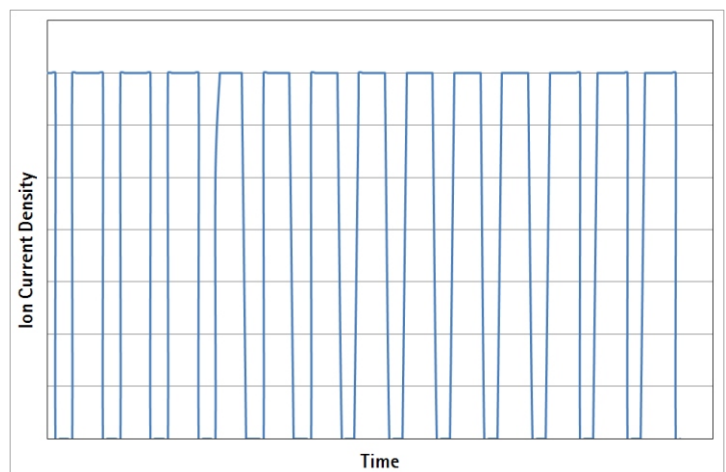
LPPE-ALD

Low Pressure Plasma Enhanced Atomic Layer Deposition

Pressure range:
1E-2 mbar to 1mbar

Plasma ignition time:
50 msec

Chemical response time:
100 msec.

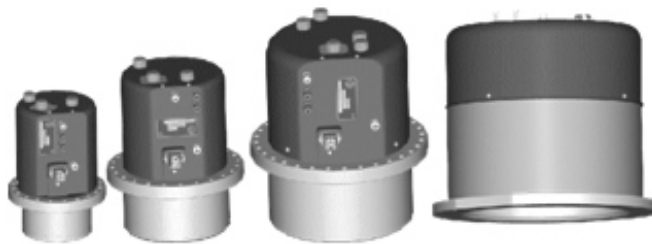


High amount of atomic Nitrogen and Oxygen allows the formation of Oxides and Nitrides at Substrate Temperatures below 80° C

ALD on polymer like substrates like Polycarbonate is possible

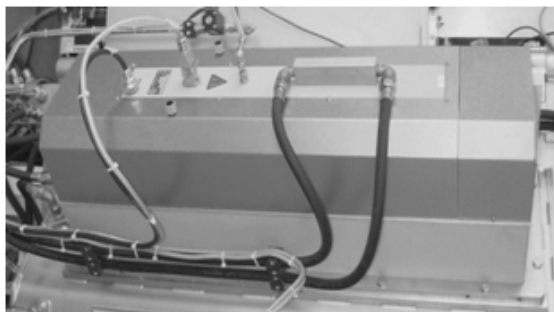
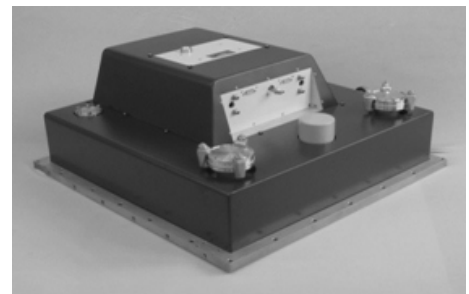
Scalability

The design of the COPRA Technology allows one easy integration to all industrial substrate sizes and shapes. Round substrates and flat panels can be treated up to 1400 mm in dimension



COPRA 160 to COPRA 500 round Sources. 30 to 300 mm substrates.

COPRA LS9 and LS10 Rectangular Sources
360 to 1200 mm.



COPRA LS6 and LS12 Line Sources.
600 mm to 1300 mm dynamic processing.



COPRA OVERVIEW

6

COPRA Model	Plasma Size	Max RF-Power	PECVD	ALD	Assist	Cleaning	Chemical Etching	Physical Etching
DN 160 CF	Ø = 84 mm	600 W	√	√	√	√	√	√
DN 200 CF	Ø = 122 mm	600 W	√	√	√	√	√	√
DN 250 CF	Ø = 162 mm	1800 W	√	√	√	√	√	√
DN 250 ISO-K	Ø = 162 mm	3000 W	√	√	√	√	√	√
DN 400	Ø = 264 mm	5000 W	√	√	√	√	√	√
DN 500	Ø = 398 mm	5000 W	√	√	√	√	√	√
LS 5	400 x 160 mm ²	5000 W	√	√	√	√	√	√
LS 6	863 x 165 mm ²	5000 W	√	√	√	√	√	√
LS 9	500 x 500 mm ²	5000 W	√	√	√	√	√	√
RS 400	Ø = 400 mm	5000 W	√	√	√	√	√	√
RS 9	500 x 500 mm ²	5000 W	√	√	√	√	√	√
RS10	800 x 800 mm ²	10.000 W	√	√	√	√	√	√
RS11	1200 x 1200 mm ²	15.000 W	√	√	√	√	√	√
IS-300	Ø = 220 mm	3000 W	√	√	√	√	√	√



Camp-Spich-Str. 3a
D-53842 Troisdorf
Tel.: +49 (0) 2241-93215-0
Fax.: +49 (0) 2241-93215-200
Email: contact@ccrtechnology.de
www.ccrtechnology.de

DISTRIBUTORS

Italia

Plasma Focus srl
Phone: +39 - 0383 1931066
Fax: +39 - 0383 1931067
info@plasmafocus.it

Benelux

Benelux Process bvba
Phone: +32 (0)9 231 18 64
Fax: +32 (0)9 252 23 93
info@benelux-process.com

France

Aexor SARL
Phone: +33 - (0) 6 13 61 49 20
Fax: +33 - (0) 1 69 85 24 27
c.vignolles@aexor.eu

U. K.

John Punnett
Phone: +44 - (0) 7802 397227
john@jp-technologies.co.uk

India

Simco Global Technology Systems Ltd.
Phone: +91-11-2689-9867
Fax: +91-11-2612-4461
simcorsd@del2.vsnl.net.in

Taiwan

JUNSUN Tech. Co. Ltd
Phone: +886-2-2908-1350
Fax: +886-2-2908-1305
junsun@ms10.hinet.net