Gencoa company and product overview presentation for the Radical Assisted Sputtering

Perfect your process with GENCOA Components & Technology

GENCOA

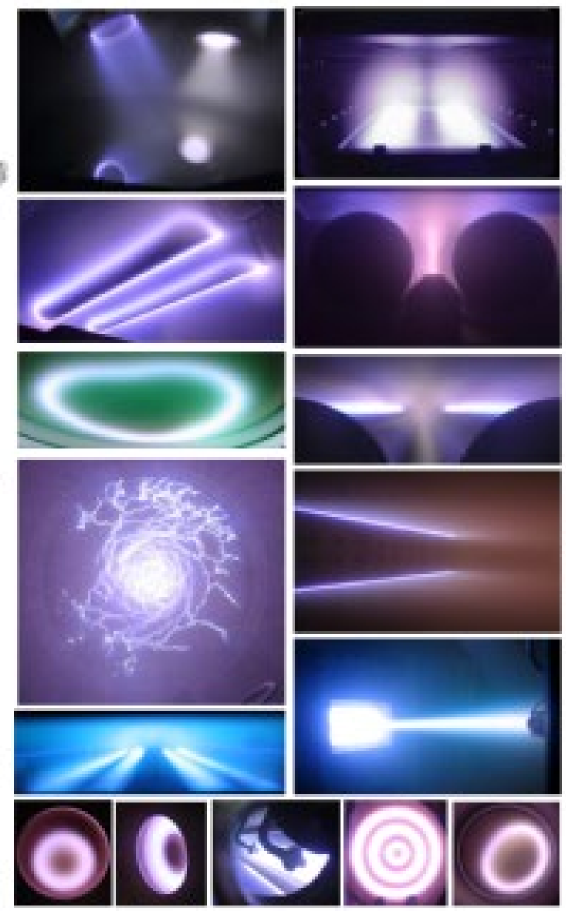
Gencoa Ltd, UK

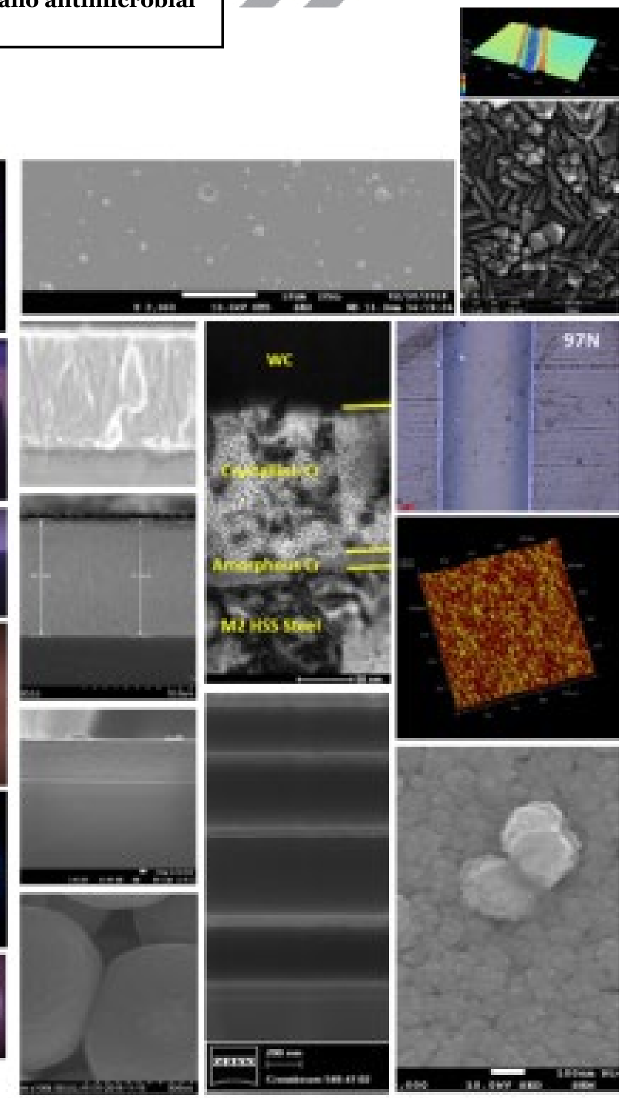
Linear High Power Gas Source for Plasma Processing - PgO2MF

Pre-treat and Radical Assistance Sputtering

25 Years of of Products and Technology from Gencoa

Rotatable & Planar Magnetron Sputter Cathodes • Retrofit magnetic packs • Plasma Treaters • Speedflo Reactive Gas Controllers • IM Ion Sources & power supplies • Arc MAX sources & power supplies • Active Anodes and Gas Delivery Bars • OPTIX Gas and Chemical Sensing • S and Se Sensor • PEC Pulsed Effusion Cell • V^+DLC - Transparent DLC • IC Nano antimicrobial layer technology • Process implementation & tuning •





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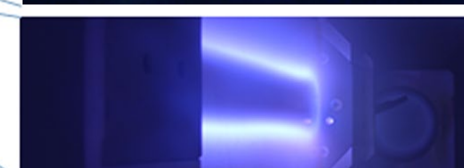
Plasma Generation and Pre-treatment options available

Plasma Treatment Product Categories:	**Application / use**
Glow Discharge	Low speed web
DC Linear ion sources	Low speed web & glass
DC magnetron based plasma treaters	Low to High speed / power
AC type plasma cleaning dual tube electrode	Low to High speed / power
AC type gas activation sources – plasma generation for reactive gas reactions	Low to High speed / power
Positive pulsed power inverted magnetron plasma source	Low to High speed / power

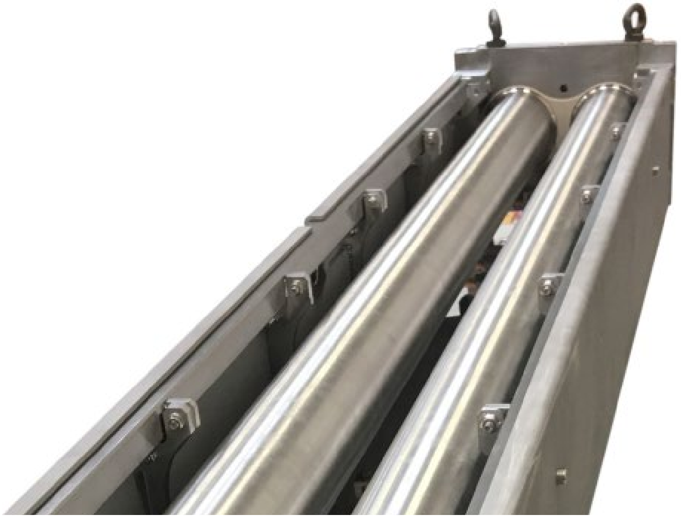


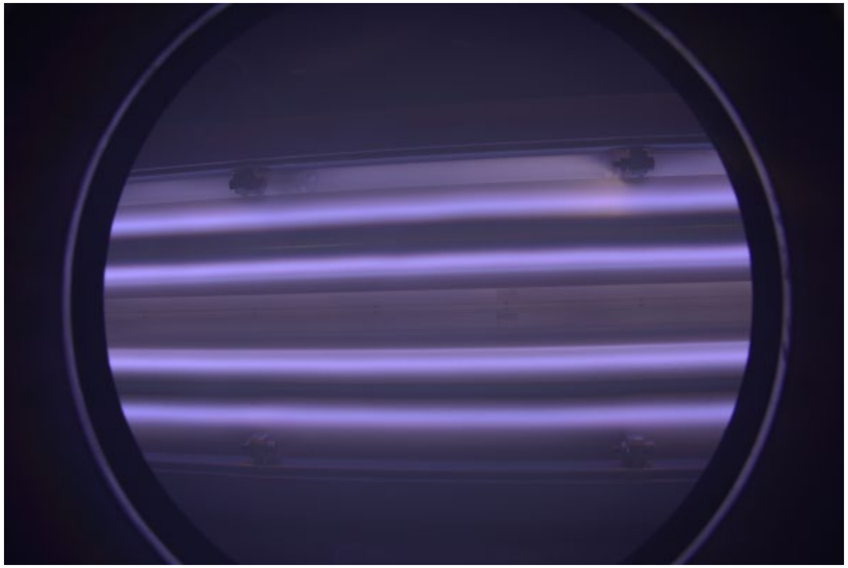


High power plasma gas source for Pre-treating and Radical Assisted Sputtering

- Modern alternative to RF and Microwave powered active gas sources – no power or scaling issues – 0.2 to 4m lengths
- Up to 40 Amps of plasma electrode current per m length
- Highly activated gas species with 70 eV energy
- Added kinetic energy of gas to aid layer oxidation & pre-cleaning
- Pure gas plasma – no etching of electrodes
- No maintenance
- Uses Gencoa DLIM patent - Active Anode gas excitement



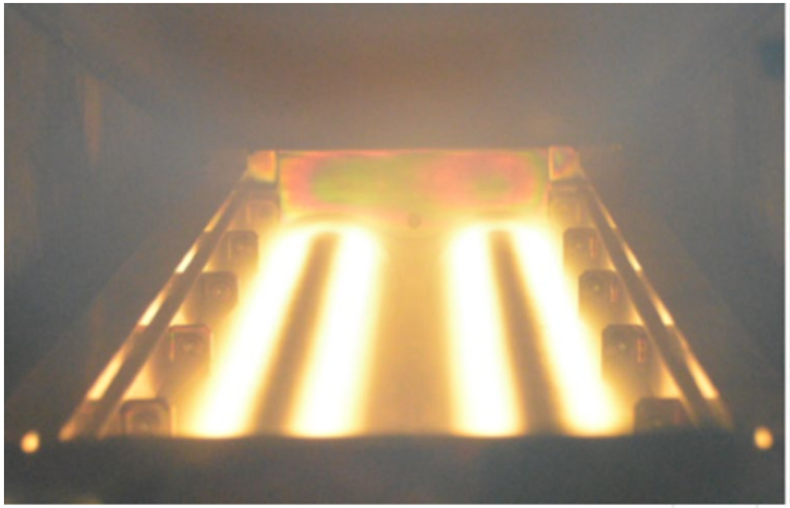


Easy to operate and low maintenance

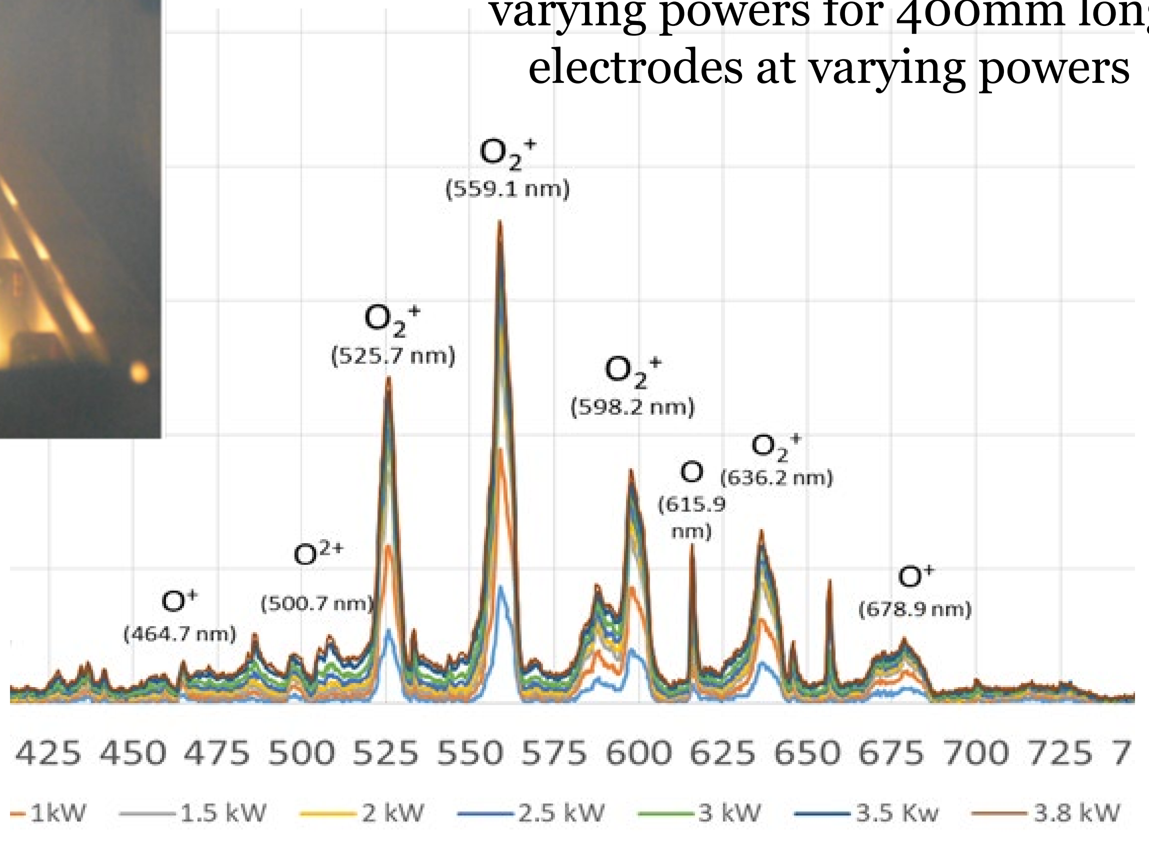
- The power is switched between 2 water cooled electrodes in the presence of oxygen gas and a magnetic field. The resulting plasma ionizes the oxygen gas species and also provides an electron shower for neutralisation which avoids charge build-up on the substrates.
  - Shields are water cooled for low temperature processing
    - No coating generated, no debris and hence no cleaning required

External source mounting with chamber interface flange

Single and double ionisation of the Oxygen atoms and molecules for extra reactivity of the sputtered metal surface

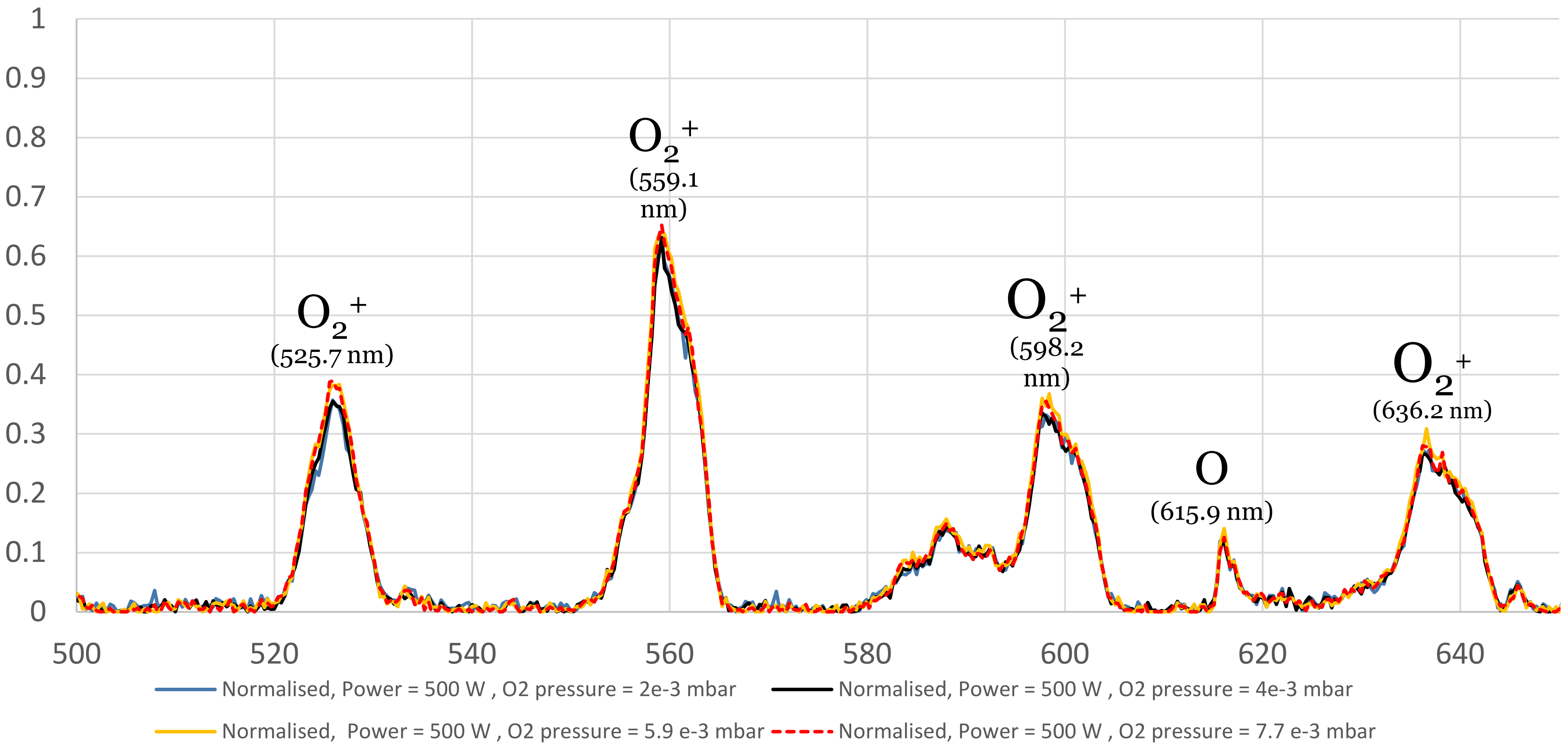


Plasma Emission Spectra at varying powers for 400mm long electrodes at varying powers



Plasma Spectrometry with changes in O_2 pressure at 500 W

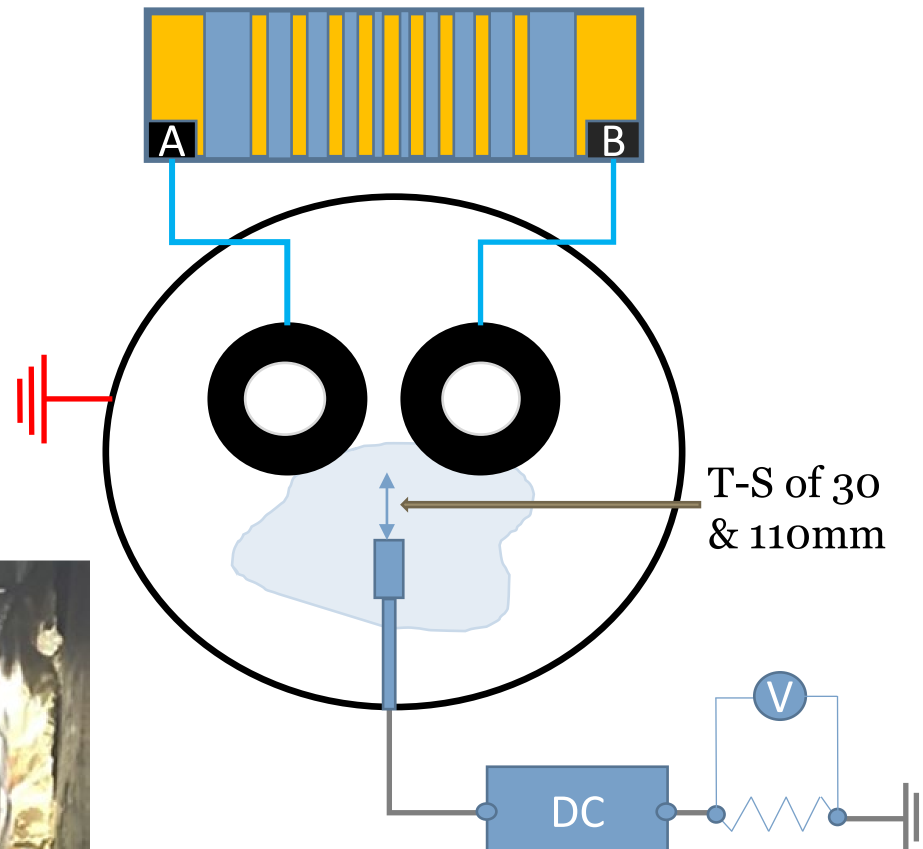
- there is little change in the ion/neutral ratio over the O2 pressure range



Langmuir Probe Measurements

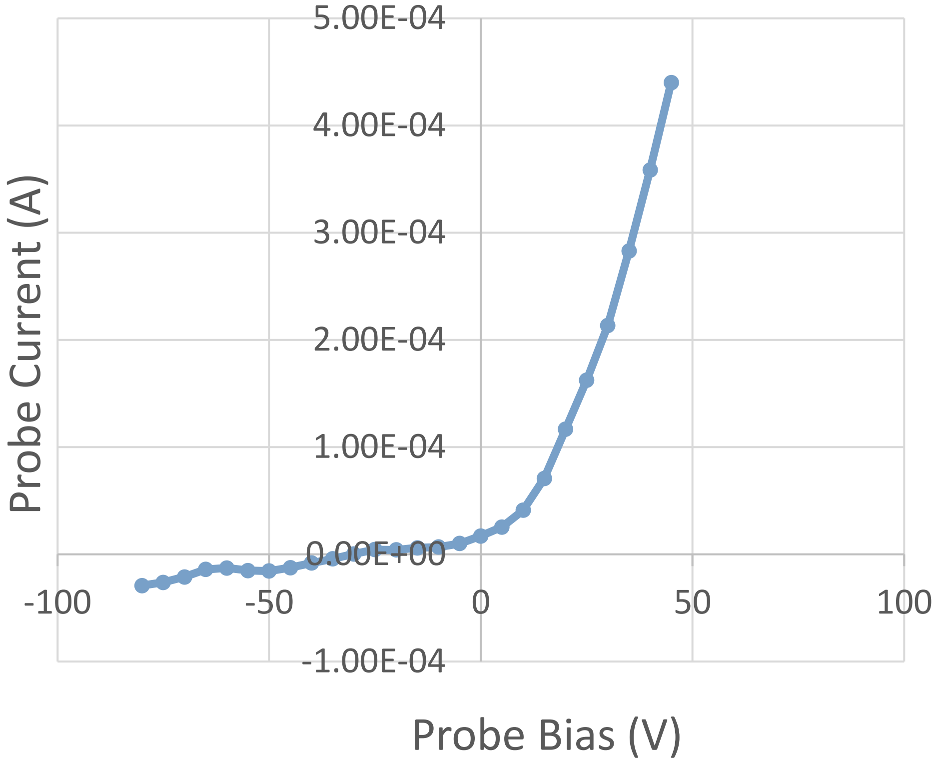
A circuit containing a DC power supply and resistor (75 kΩ) was attached to an electrostatic probe

The probe was triggered with the pulsed target voltage to obtain a synchronization of time-resolved measurements with the pulsed power supply of the discharge



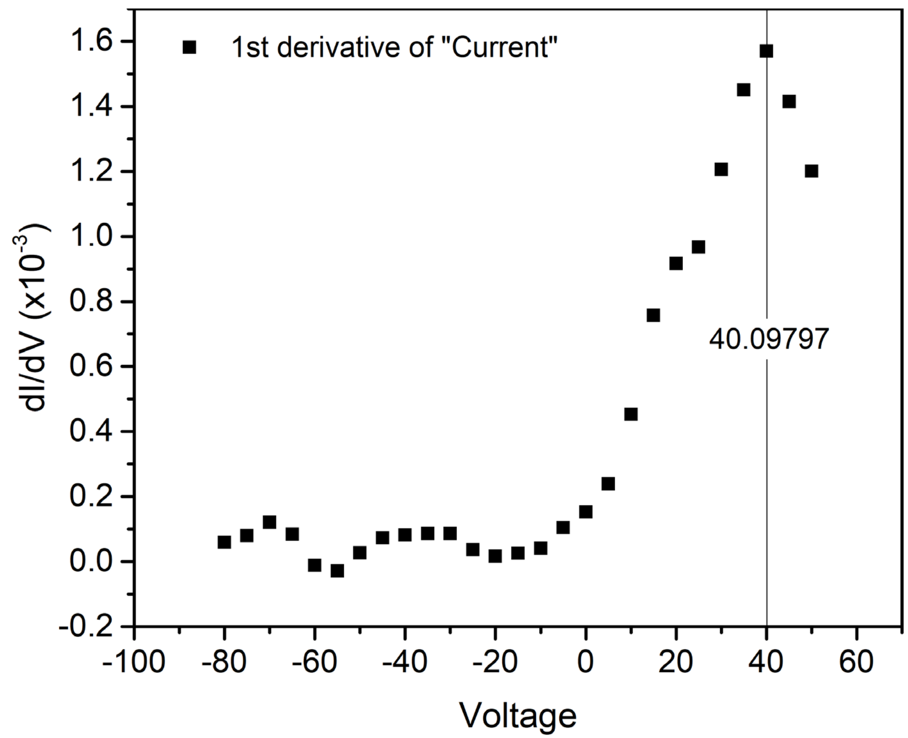
Langmuir Probe at 110mm from source electrodes & 1 kW

- Measurements at a pressure of 5e-3 mbar (in O2) and 1kW of plasma
- The ion saturation current (I_sat) is found to be around 0.00002 A and the floating potential (V_f) is around -33 V
- The flux of +ve O2 ions to the probe surface (Γ) is estimated to be ~ 10^16 m^-2 s^-1
- To find the plasma density, we use Γ = nv where n is the plasma density and v is the ion sound speed.
- Assuming an electron temperature of 10 eV, the plasma density at 1 kW of power is estimated to be on the order of 10^14 m^{-3}
- The current density was estimated to be ~ 0.5 cm^{-2}

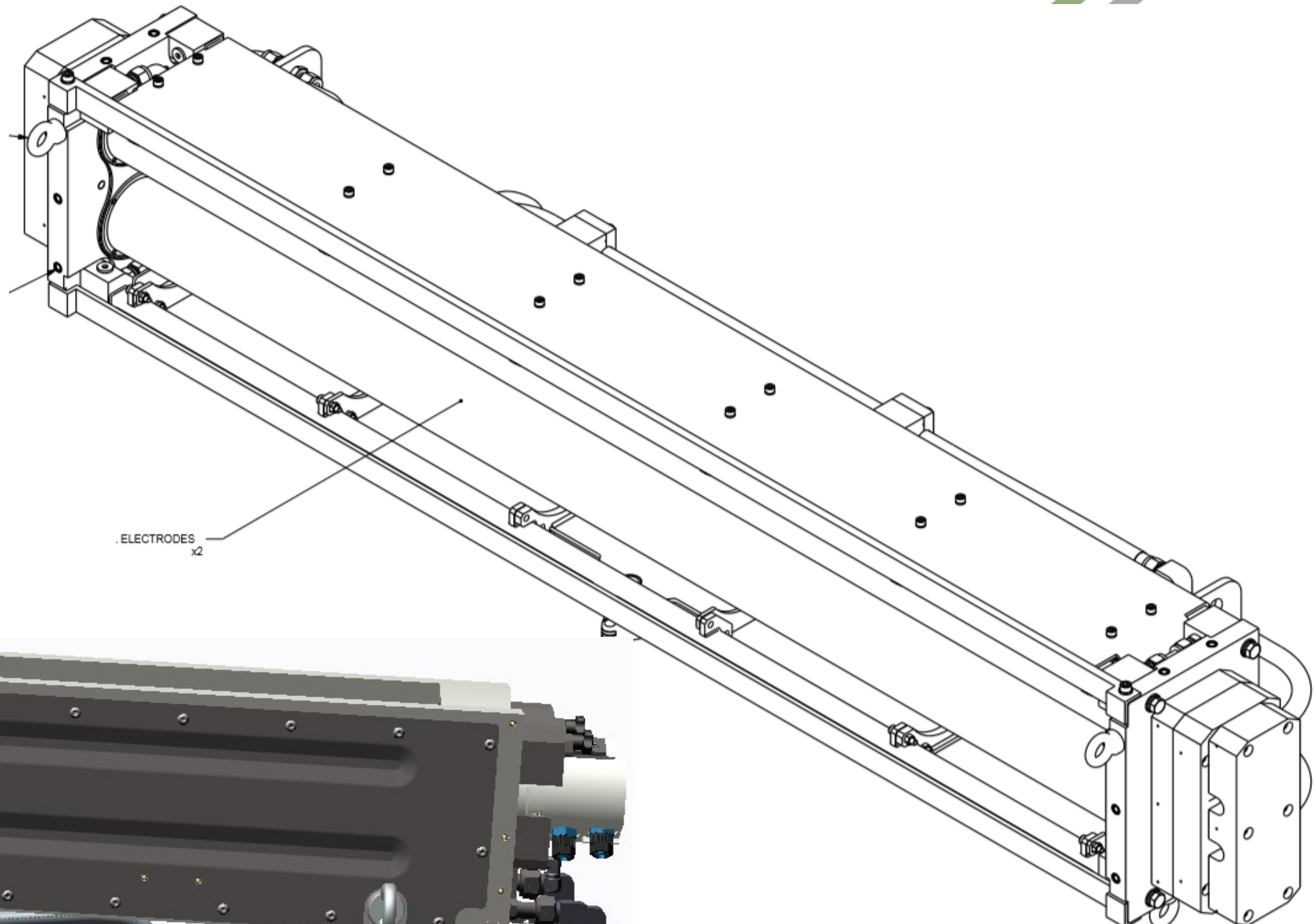


Langmuir Probe at 110 mm

- To find the plasma potential (V_p) we calculate dI/dV, and find the peak in the distribution
- This measurement indicates a V_p of ~40 eV
- Assuming a floating potential of -33 V, this would imply ions bombard surfaces with energies of > 70 eV

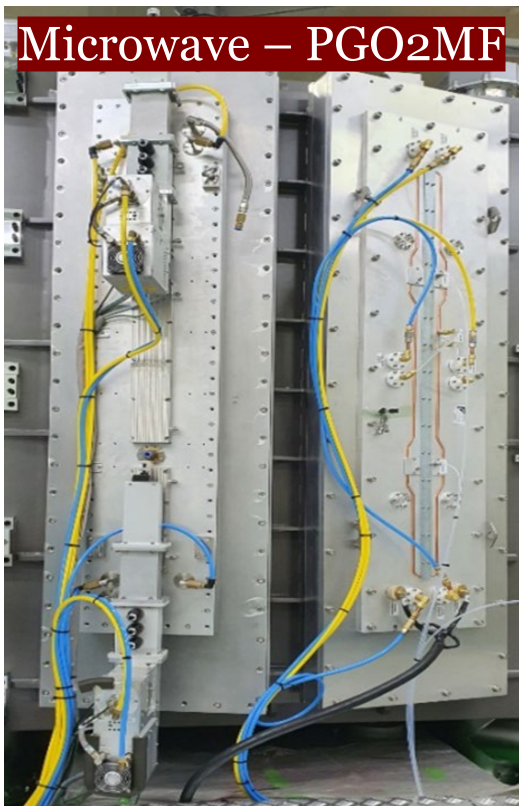


High power plasma gas generation different lengths based upon space and capacity, internal or external mounting

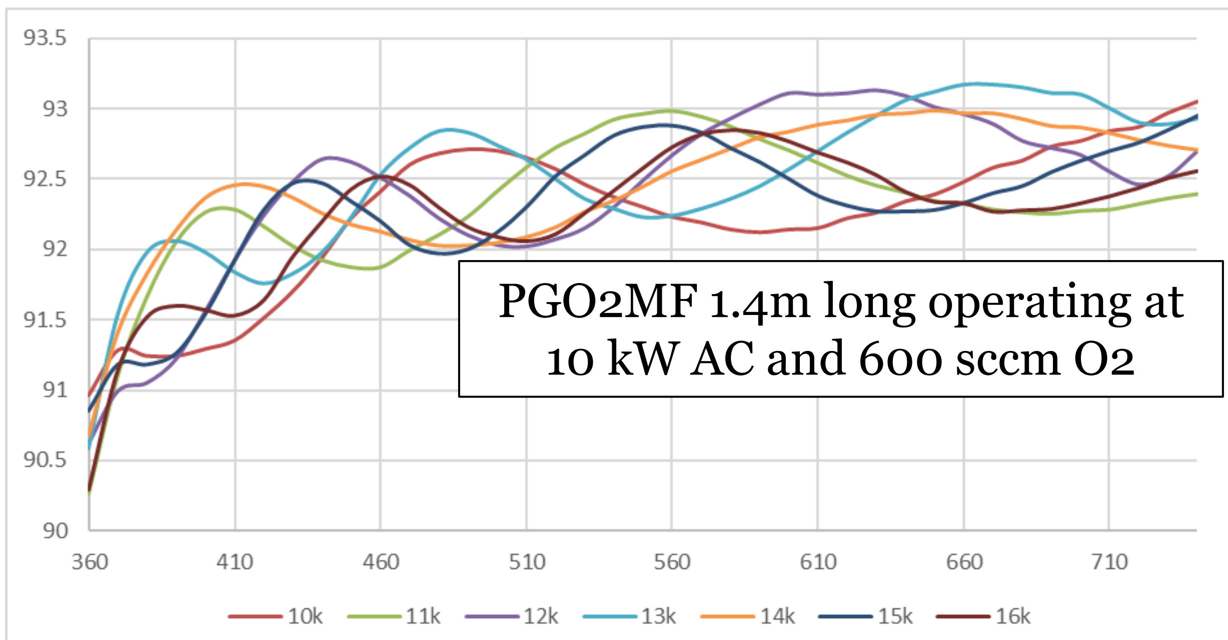


Comparison of Microwave plasma source and Gencoa PgO2MF

- PgO2MF produces same uniformity & optical layer quality as MW
- Rate is 10% higher for the PgO2MF at the same sputter target power
- MW cannot operate above 14kW sputter power, PgO2MF has no sputter target limit (increase the AC power and O2 gas flow), at 16kW, rate is 20% higher than MW max rate



PGO2MF can also pre-clean the substrates in 5-10 minutes



SiO_2 transparency at different Si target sputter powers

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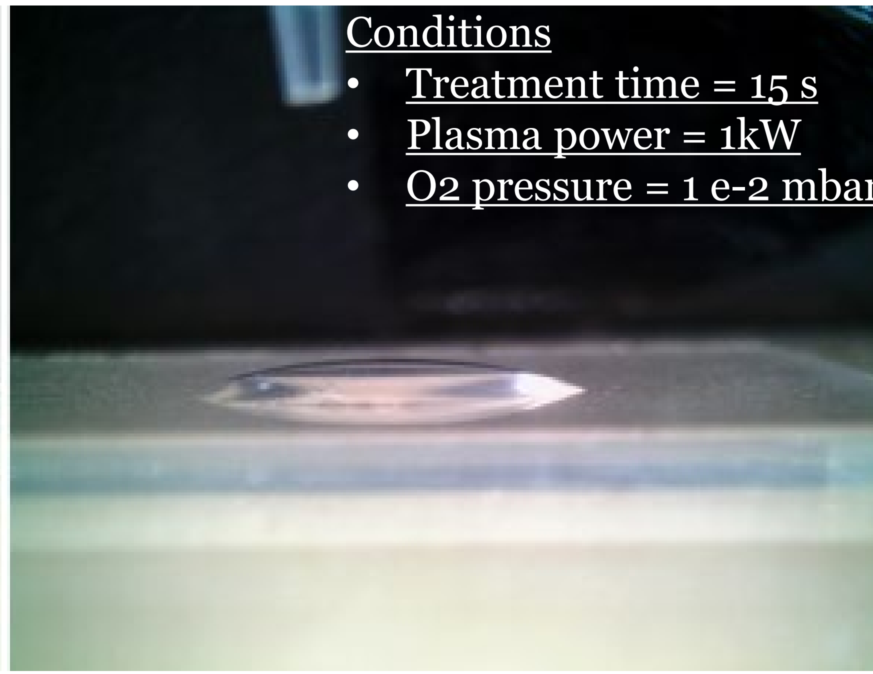
COMPACT – small space

Easy to scale in length, Internal or external designs
Lower cost power mode compared to RF and MW

Contact angle measurements

Untreated Surface

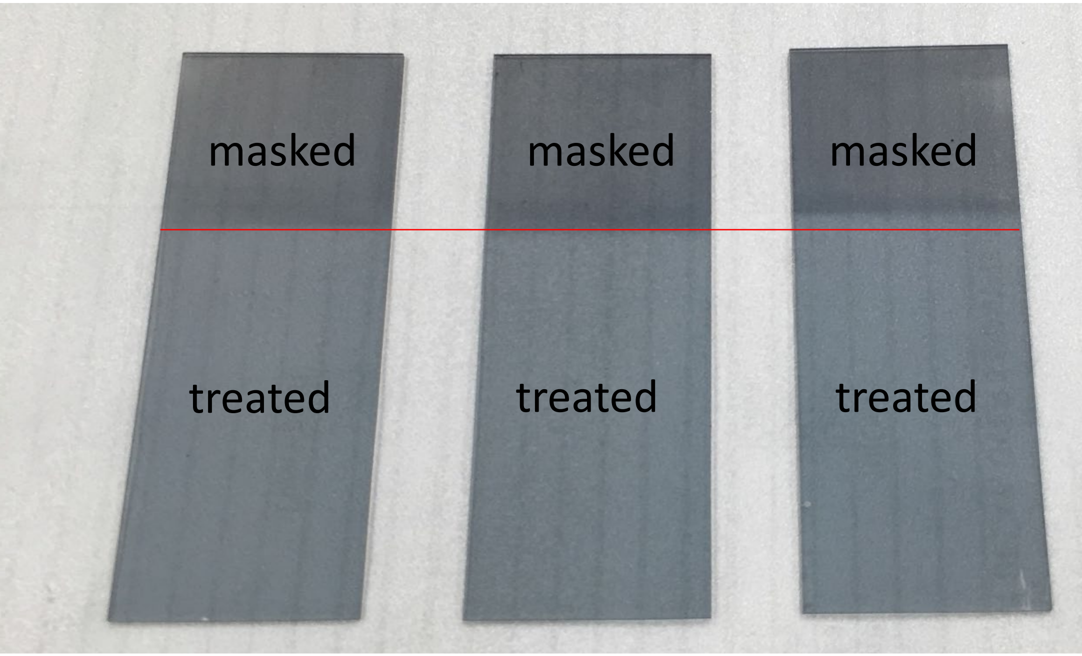
Treated Surface

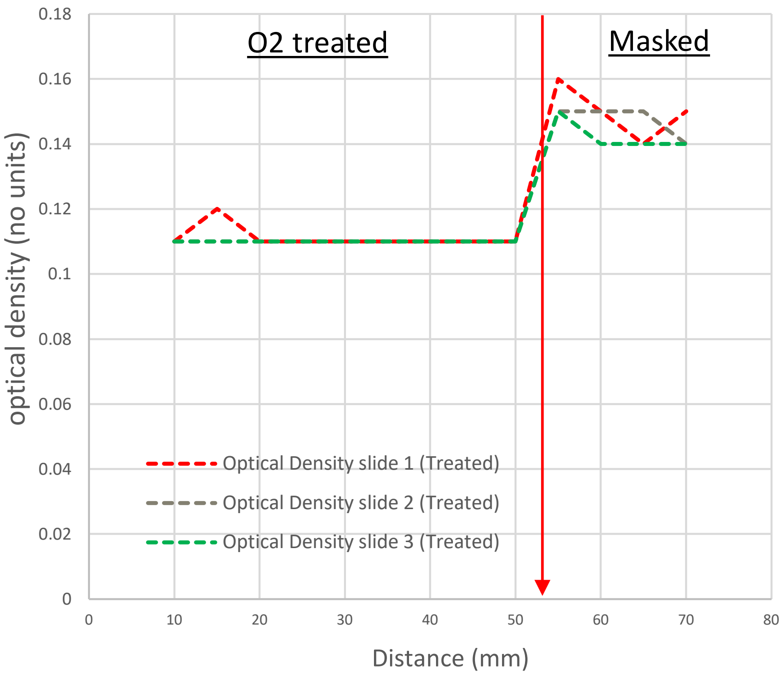


- The oxygen plasma provides 70eV bombardment of the surface plus kinetic energy as ions repelled from electrodes as power switches to +ve potential.
- Hence can be used to pre-clean the substrates prior to coating

O_2 activation of Al coatings

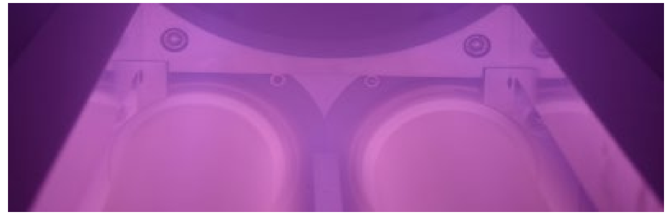
- 15nm of Aluminium was pre-coated onto glass slides which were then exposed to O2 plasma at 2kW for 30 minutes





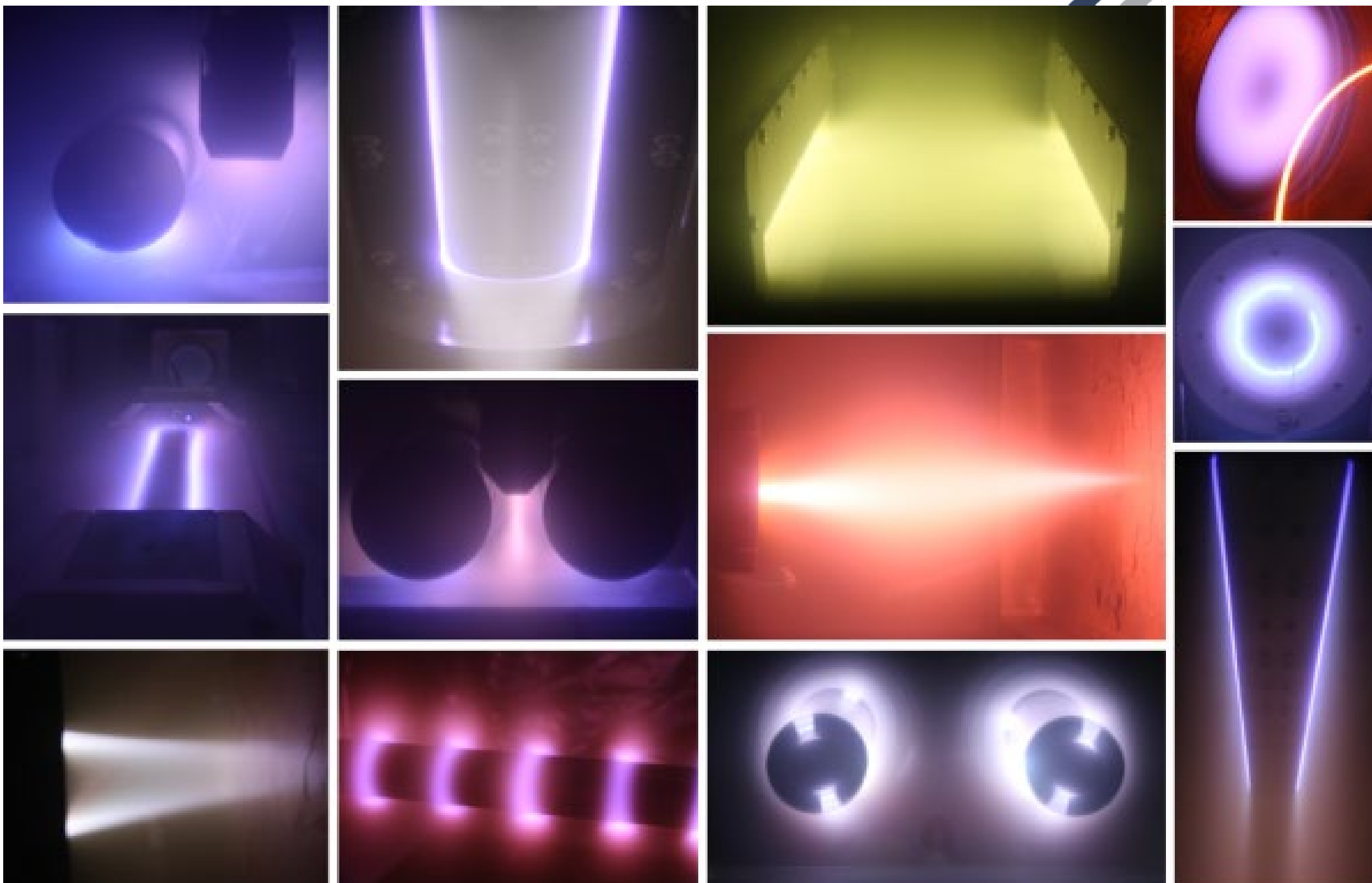
- The results show a decrease of ~30% in the optical density between the masked and treated regions of the Al pre-coated slides
- A surface depth of pre-coated Al has been oxidised – source can be used for pre-cleaning of substrates as well as radical assisted sputtering

Gencoa **GPgO2** Plasma gas excitation sources



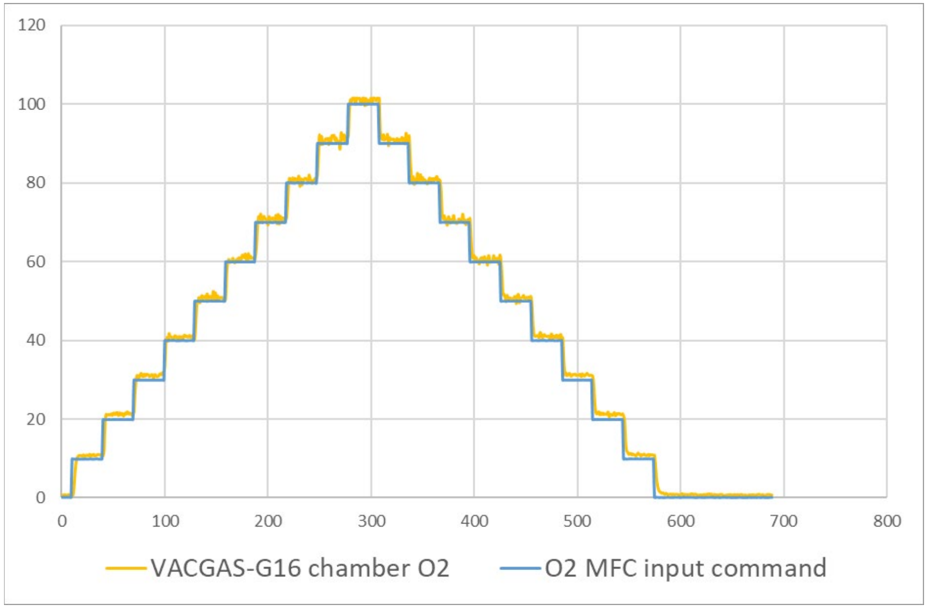
Perfect your process
Switching of high intensity plasma – high power capacity – no limits on source lengths
Self-neutralized switching plasma potential – no charge build-up on substrate or target – substrates receives both negative and positive bombardment
Double electrode – switching from positive to negative so stable and without drifting of plasma properties and high plasma uniformity
Highly scalable and controllable, plasma runs in pure oxygen (or N2) without argon
No cleaning of electrodes or changing as no sputtering occurs – no maintenance
Lower cost and more scalable than RF and microwave plasma generation devices

GENCOA has many ways to create a plasma



Gencoa VACGAS-G16 - vacuum gas sensing for Chalcogen species
VACGAS-G16 Sensor

- High Accuracy and low cost O_2, S & Se sensing in vacuum
- The GENCOA VACGAS-G16 sensing unit provides an industrially robust means to sense elements of group 16 - The Chalcogens. The most important species in group 16 from a vacuum processing point of view are oxygen, sulphur and selenium.
- The VACGAS-G16 combines fast feedback control of the sensor temperature with gas correction to provide the O_2 level as a precise partial pressure.



Thank you for your attention!

Please visit gencoa.com for more information