thin film and pv solutions

components for sputter deposition, process control and plasma treatment
Rectangular magnetrons

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GENCOA is a private limited company (Ltd)

Founded 1995 by Dr Dermot Monaghan

Located in Liverpool, UK

Employs 34 people
- 6 design (Pro E 3D CAD)
- 4 process development & simulation
- 14 assembly & test
- 4 sales & tech support (2 Asia based)
- 3 administration & accounts
- 3 hardware & software (Speedflo)

> 3000 magnetrons in the field

> 500 speedflo systems in the field 95% market share
GENCOA products cover 3 sputtering related areas

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Magnetron Sputter Cathodes planar & rotatable

Reactive gas controller & endpoint detector

Linear ion sources

Other activities include on-site process implementation, training and tuning
Sales agents / distributors located around the world and 95% of output is exported from the UK

Main markets are USA, EU, Japan, Taiwan, Korea & China

Local Gencoa based staff for technical support in USA, EU & Asia
- GENCOA provide process solutions by supplying components and know-how that exceeds your expectations:

- 8 types of magnetic systems for rotatable magnetrons
- 10 types of planar magnetic designs
- On-site process implementation
- Unique PDF+ algorithm for reactive gas process control
- In-situ and ex-situ* PEM, lambda sensor, target voltage
- Key IPR covering dual rotatable magnetrons and magnetic anode assisted rotatable processes.

*constant innovation, customer satisfaction, process support, in-depth understanding, experts: simply better solutions. Gencoa.*
Key Advantages

- GENCOA have spent 17 years perfecting planar magnetron designs to provide the best process solution combined with highly robust components:

  - Optimized magnetic fields to get the best possible target use & target cleanliness.
  - Zero-height anodes to prevent shorts during processes and reduce dust and defects in the coatings.
  - RF standard electrical insulation on all magnetrons.
  - Integral anodes with optional gas injection.
  - M8 screws for target clamping and no heli-coils for rapid target changing and no seizure.
  - Efficient diaphragm type cooling for high power operation without breaking a water seal during target changeover.
Confinement between a negatively biased target and ‘closed’ magnetic field produces a dense plasma.

High densities of ions are generated within the confined plasma, and these ions are subsequently attracted to negative target, producing sputtering at high rates.
Building a good 3D magnetic design for plasma control

**GENCOA** have advanced 3D magnetic modelling capabilities that provide accurate simulations of the magnetic fields used in the magnetron cathodes. This allows optimization of the magnetic field properties:

- Magnetic flux density (strength) over the target surface
- Shape of the magnetic field lines that control electron trajectories – determines the plasma distribution and target erosion shape
- Interaction of the magnetic field lines with the anodes, substrates and vacuum chamber components – controls the target ‘cleanliness’ and the level of substrate heating / ion release from the magnetron
Electron density over the target & erosion prediction helps to design the magnetic field and enhance performance.
Modelling example - target erosion profile for FFE – time dependant

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FFE magnetic field densities & electrons’ trajectories help predict performance

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Magnetic field design for centre clamped SW200 ‘HY bar’ field plot
A wide range of optimized magnetic options available for all applications

<table>
<thead>
<tr>
<th>magnetics</th>
<th>features</th>
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<tbody>
<tr>
<td>SW</td>
<td>Standard optimised balanced 2 pole magnetics</td>
</tr>
<tr>
<td>PP</td>
<td>Standard optimised unbalanced 2 pole magnetics for ion assist</td>
</tr>
<tr>
<td>HY (SW or PP)</td>
<td>High yield multipole magnetics for &gt;45% target use</td>
</tr>
<tr>
<td>VT</td>
<td>VTech constantly variable system between SW and PP</td>
</tr>
<tr>
<td>FFE</td>
<td>Full face erosion for clean targets and low defects</td>
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<tr>
<td>LP</td>
<td>LOOP design for ferro-magnetic target sputtering</td>
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<tr>
<td>HS</td>
<td>High strength magnetics for low pressure &amp; low voltage sputtering</td>
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<tr>
<td>RF</td>
<td>Low strength magnetics for 13.52MHz sputtering</td>
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</table>
Target erosion example for standard SW 2 pole magnetics

SW - balanced 2 pole magnetics
Example of PP type unbalanced 2 pole magnetics

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Comparison of standard 2 pole and high yield type magnetics

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2D magnetic field model for an High Yield type of design

2D magnetic field model for an standard 2 pole type of design
HY type magnetic arrays yield 40-60% target use

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Metallizer for 100% increase in up-time – thicker profiled targets
Target Erosion by FFE type magnetics

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Vtech type fully variable magnetics, varies field strength, shape and balance/unbalance
An example of a LOOP source for Magnetic Targets
Magnetic options include the following:

<table>
<thead>
<tr>
<th>Magnetic Type</th>
<th>Target Use %</th>
<th>Application</th>
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<tbody>
<tr>
<td>SW – balanced 2 pole</td>
<td>25–30</td>
<td>Standard source for general processing</td>
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<tr>
<td>PP – unbalanced 2 pole</td>
<td>25–30</td>
<td>Standard source for ion assisted deposition</td>
</tr>
<tr>
<td>VT – vtech variable</td>
<td>25–40</td>
<td>Varies ion assist magnetic strength</td>
</tr>
<tr>
<td>HY – high yield</td>
<td>40–50</td>
<td>Enhanced target use source</td>
</tr>
<tr>
<td>LP – loop for ferromagnetic</td>
<td>25–40</td>
<td>Thick Ferro–magnetic target material sputtering</td>
</tr>
<tr>
<td>MZ – metallizer</td>
<td>50–60</td>
<td>Very thick metallic targets</td>
</tr>
<tr>
<td>FFE – full face erosion</td>
<td>40–60</td>
<td>Clean target sputtering even in reactive mode</td>
</tr>
<tr>
<td>AS – double magnetron</td>
<td>see above</td>
<td>Reactive dielectric deposition</td>
</tr>
</tbody>
</table>
High target use and high uniformity combined

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Al coating on SW200950, 8cm t-s, 7.9w/cm², 80 seconds

Coating thickness, average (nm)

Position along the target length

1.3% over 570 mm

3.6% over 760 mm

26.8% over 950 mm
Standard rectangular magnetron target widths available

40 mm (SW type) add RF
50 mm (SW type)
65 mm (PP type only)
75 mm (Vt, LOOP, SW & PP type)
89mm (LOOP)
100 mm (Vt, LOOP, SW & PP type with the option of HY)
125 mm (Vt, LOOP, SW & PP type with the option of HY)
150 mm (Vt, LOOP, SW & PP type with the option of HY)
200mm (SW type with the option of HY – has centre clamping)
250mm (SW type with the option of HY – has centre clamping)
300mm (SW type with the option of HY – has centre clamping)

The target lengths are in increments of 50mm. Special non-standard lengths are available but may incur a surcharge.
Example of external cathode standard rear connection points

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- Water In (Blue Ring)
- Support Pillar
- Flange Cooling
- Power Connector
- Water Out (Red Ring)
- Lifting Plate
- Gas Input (Single Zone)
Small sources for R&D with the option of VTech fully adjustable magnetics

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Specialist RF magnetrons in SWRF and HYRF magnetic forms

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Specific RF cathode design and magnetics and optional matching unit mounting

Upto 30 kW RF capacity
Specific RF cathode design and magnetics and optional matching unit mounting
Optional RF blocking filter for use on DC cathodes in the same chamber as RF plasma’s – to protect DC PSU.
Dual cathode web-coating technology

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Small cantilever mounted dual cathodes

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Large area web coating sources for reactive coating for touch screens

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Internal drop-on mounting for customer self-manufactured cantilever support

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Integrated gas delivery system for reactive sputtering and uniformity tuning for large area dual cathode sputtering

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Large area reactive deco-coater with PEM and gas delivery

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200mm wide centre clamped magnetrons for thin film solar cell production

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Externally mounted double sources for CIGS solar cells
Large area external flange mount with gas injection for ceramic AZO

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Example of standard internally mounted magnetrons with bellows connection point

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Water cooled anode heat removal from the process and surrounds

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PEM sensing, cooled anode and gas injection for reactive sputtering and uniformity control
Large area high energy unbalanced magnetrons for bond layers on mobile phones

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OEM proprietary magnetrons design and manufacture service

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Complete sub-systems supplied

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Example of plasma pre-treating magnetron and small double cathode

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For OLED and touch screens
Process module for high rate metallisation for decorative applications

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Drop-in process module for reactive sputtering

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Special assemblies for specific customer machine requirements

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From production to research, we can satisfy your needs

Thank you for listening