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
Other activities include on-site process implementation, training and tuning.

GENCOA products cover 3 sputtering related areas:

- **Magnetron Sputter Cathodes**
  - planar & rotatable

- **Reactive gas controller**
  - & endpoint detector

- **Linear ion sources**
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.
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.
• **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 dependent

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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

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A wide range of optimized magnetic options available for all applications

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<table>
<thead>
<tr>
<th>magnetics</th>
<th>features</th>
</tr>
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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>
</tr>
<tr>
<td>RF</td>
<td>Low strength magnetics for 13.52MHz sputtering</td>
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</tbody>
</table>
Target erosion example for standard SW 2 pole magnetics

SW - balanced 2 pole magnetics

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| gencoa: perfect your process | Example of PP type unbalanced 2 pole magnetics |

[Image of a PP type unbalanced 2 pole magnetics]
Comparison of standard 2 pole and high yield type magnetics

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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SW100300HY  SW125050HY  SW150700HY  SW200050HY
Metallizer for 100% increase in up-time – thicker profiled targets

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mZ™

G
Target Erosion by FFE type magnetics

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Vtech type fully variable magnetics, varies field strength, shape and balance/unbalance.

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An example of a LOOP source for Magnetic Targets

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Magnetic options include the following:

<table>
<thead>
<tr>
<th>Magnetic Type</th>
<th>Target Use %</th>
<th>Application</th>
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</thead>
<tbody>
<tr>
<td>SW – balanced 2 pole</td>
<td>25–30</td>
<td>Standard source for general processing</td>
</tr>
<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>
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)
- 89 mm (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)
- 200 mm (SW type with the option of HY – has centre clamping)
- 250 mm (SW type with the option of HY – has centre clamping)
- 300 mm (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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Example of cathode anode and target mounting

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Anode Assembly
(Anode Wall & Anode Assembly)

Target Clamp Assembly

Diaphragm
Examples of different magnetrons and options

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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

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Upto 30 kW RF capacity
Specific RF cathode design and magnetics and optional matching unit mounting

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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
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
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 |
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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