# SIERRA APPLIED

Integrity. Innovation. And unmatched planar magnetron cathode performance.



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If we've learned one thing in our years in business, it's that a company is made or broken on its reputation. For Sierra Applied Sciences, that reputation is built on integrity, innovation and a singular customer focus.

# **Customers** First

As a result, Sierra leads the market in building and delivering high-performance planar magnetron cathodes for the thin-film industry. With our cathodes and engineering support, we help customers design, develop and produce products ranging from CDs, optics, and magnetic heads to magnetic media, coatings and more — quickly and cost-effectively.

And we make it easy. You can rely on us for the most advanced solutions. Honest answers. Exceptional quality. Consistently repeatable performance. And knowledgeable engineers who respond to your needs fast.

At Sierra, you come first. That's not just a promise, it's a fact.

# Applied thinking

#### The simpler, the better

Sierra can help you simplify the creation of even your most complex products ... and produce them more efficiently and cost-effectively. You need truly plug and play cathodes. We guarantee it. You need longer target life. We deliver the best utilization in the world. You require easy integration. Our cathodes actually help streamline production. You demand a supplier who understands and responds to your needs. We go further — we also anticipate your needs for tomorrow.

One way we do that is by continually improving target utilization and simplifying our designs. Based on shaping magnetic fields to control erosion tracks, our cathodes deliver substantially higher target utilization and deposition consistency than others. The difference is so significant, you can see it both in side-by-side comparisons and your product's performance.

Innovation is the future. Today, the tradition of innovation we began in 1989 continues with a multi-year R&D initiative that has already yielded exciting break-throughs in planar magnetrons, ion source/anodes and power supplies. All of this will be integrated into an even more efficient sputtering process to help you advance your products for years to come.



# **Design simplicity**

#### Ensures unmatched reliability

ierra's patented designs are based on symmetry, extremely efficient mechanical assemblies and the smallest possible number of parts. This design simplicity eliminates multiple points of potential failure and ensures cathodes of unparalleled reliability that are both easy to use in production and simple to maintain.



Here, a fully assembled Ø6" internal cathode with an eroded aluminum target and a disassembled cathode clearly show Sierra's symmetry, design simplicity and low parts count.



Internal cathodes are mounted inside the vacuum chamber. Water and power are delivered via an atmospheric connection.

### For the solutions you need

**Sound cathodes.** Name your size. Sierra's round cathodes range from 2 to 12 inches with internal or flange mountings. You can also opt for our proprietary internal process gas manifold to enhance cathode performance. Because it mounts outside the coating zone, the manifold further reduces maintenance and distributes process gas more evenly across the target's surface.

Flexibility

Rectangular cathodes. With widths of 2 to 11 inches and lengths up to 140 inches, you can get Sierra's rectangular cathodes in virtually any size you're likely to need. Like our round cathodes, you can choose from several different mounting styles and add the process gas manifold on any rectangular cathode.



A fully-assembled flange-mount cathode and disassembled internal-mount cathode are shown. Both are 5"x15".



### Maximize target utilization

hoosing a magnetron cathode that maximizes target utilization and life can dramatically affect the quality, performance and longevity of your products.

Unlike others, our patented magnet design traps electrons in inner, center and outer erosion zones with magnetic field shapes that are carefully balanced for even erosion. So although competitors may claim similar performance, you can see our cathodes' superior performance in longer target life.

In addition, we use two calculations to express target utilization — one measuring target weight loss and the other measuring the percentage of weight loss versus thickness when a backing plate is present. In each case, our cathodes turn in extremely consistent performance you can rely on.

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Sierra cathodes optimize target utilization for a wide range of target sizes, geometries and materials.

TARGET SIZE (in)	% UTILIZATION	kWhr	VOLUME USED (in <sup>3</sup> )	GROOVE DEPTH (in)
	NO PLATE / PLATE			
2 x 38 x 1/4	28 / 33	181	5.1	0.183
3-1/2 x 30 x 3/8	40 / 43	558	15.7	0.250
5 x 12 x 1/2	38 / 42	371	12.0	0.450
5 x 12 x 5/8	33 / 39	409	15.0	0.525
5 x 36 x 1/2	37 / 40	9 <b>7</b> 5	36.0	0.461
6 x 15 x 5/8	41 / 48	793	23.0	0.575
6 x 46 x 5/8	40 / 47	2170	69.0	0.583
8 x 36 x 7/8	44 / 50	3361	111.0	0.763
11 x 45 x 1	43 / 48	5869	173.0	0.810
Ø6 x 1/2	37 / 41	146	5.5	0.450
Ø7 x 5/8	41 / 46	346	10.0	0.555
Ø7 x 3/4	41 / 50	410	11.8	0.620
Ø8 x 3/4	38 / 49	495	14.1	0.583
Ø8 x 7/8	41 / 50	719	18.0	0.726
Ø8 x 1	42 / 49	8 <b>7</b> 0	20.2	0.820
Ø12 x 7/8	45 / 48	1576	44.5	0.790

Sierra's cathodes offer repeatable high performance. Typical results for aluminum targets, most eroded at 9kW and 3x10-3 Torr argon, are shown.

Sierra's design for non-magnetic target material is detailed in U.S. Patent #5,262,028.

### Our performance advantage

athode performance is largely dictated by plasma impedance as a function of power, which is in turn affected by size, chamber geometry and pressure.

Most cathodes with magnetic field strengths similar to ours have virtually identical plasma impedance curves. But Sierra's unique design delivers a huge advantage in process stability over the life of the target. In fact, while other cathodes may experience operating voltage drops of up to 40% as targets erode, our cathodes typically drop by just 15% to 20% cutting losses in half or less.

No other cathodes deliver performance like this.

So when you switch to Sierra's magnet designs, your current film characteristics will remain essentially the same but your process will measurably improve.



Power vs. voltage, current and impedance for a Ø6° cathode with aluminum target sputtering at 3x10°<sup>3</sup> Torr.



The simple design and inherent reliability of Sierra cathodes improve the performance and stability of deposition processes.





# The right configuration

### Styles & designs for every job

hatever the job, we'll help you get the right cathode configuration. Our round and rectangular cathodes interface to the chamber with either internal or flange-mount versions. The flange-mount cathodes, which attach to the chamber wall, can be adapted for versatile mounting options, giving you even greater design flexibility.

Easy installation also saves time and money. Power and water are connected at atmosphere and can be delivered through ISO-KF or Conflat<sup>®</sup>-style connections. Side and top ground shields simply attach to a mounting flange or chamber wall, and internal cathodes mount inside the vacuum chamber.



Common mounting options include sealing the cathode into a chamber opening using a flange or connecting internally to a NW50 flange.



Flange-mount cathode with ground shields mounted to chamber wall.

# Customize your cathodes





ometimes, only a custom solution will do. Sierra's experienced engineers are ready to design your system or work with your specs. Either way, by simulating your process with computer modeling, we can determine size, shape, deposition rate, uniformity and the best options for your requirements, including:

- Mountings
- Interfaces
- Clamping and target configurations
- Target-water membranes
- Ground shield configurations
- Gas manifolds
- Cooling water, high flow rate water or power connections
- Magnets for magnetic targets and high B-field applications

We can also supply prototypes and testing to ensure your design will work as expected.

### Sputtering magnetic materials

TARGET MATERIAL	TARGET THICKNESS (in)	% UTILIZATION	% UTILIZATION	
CoCr ALLOYS	0.375	OUR DESIGN 30	OTHER DESIGNS 15	
NICKEL	0.250	17	6	
PERMALLOY	0.200	15	5	
IRON	0.200	15	4	
CoFe ALLOYS	0.200	16	4	

Typical results using Sierra's design for magnetic materials (U.S. Patent #5,415,754) show a two- or three-fold increase in target utilization.

legant and simple, our round and rectangular cathodes for low to high permeability sputtering magnetic materials dramatically outperform the competition.

### Success is a team effort

ur engineers work closely with your engineers to get you exactly what you need. With technical expertise that includes physics, mechanical and electrical engineering, chemistry and materials science, our experienced team's flexibility and creativity can help you do more with less time and often, less money. Added to our ability to create magnetron cathodes for applications ranging from UHV to simple glass coaters, you can rely on us to help you design, develop and deliver your products to market. Fast.

#### Less risk, more productivity

You can minimize your system and process design risk using our exclusive computer modeling to help predict coating rates and uniformity, film growth statistics and target usage per coating run. And since even the most elegantly designed technology sometimes requires maintenance, you can count on full, fast technical support including cathode repair, maintenance and spare parts.

# Keeping our customers

We're proud that the overwhelming majority of our business comes from repeat customers worldwide who produce a wide array of products including CDs, magnetic heads, optical filters, tooling, roll coaters, magnetic media, architectural glass and more.

Our breadth of first-hand experience and knowledge means we understand your business and how to help you succeed. We're ready to meet your needs with our diverse cathode product lines as well as customized products for virtually any magnetron coating application. And because our cathodes save you money by reducing target costs, you have a real advantage in today's competitive marketplace.

Contact us at 303.440.0861 or visit us at www.sierraapplied.com and see all the ways we guarantee that at Sierra Applied Sciences,

our customers always come first.

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Design: Susan Davis Design; Boulder, CO Photography: David Patryas Photography





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