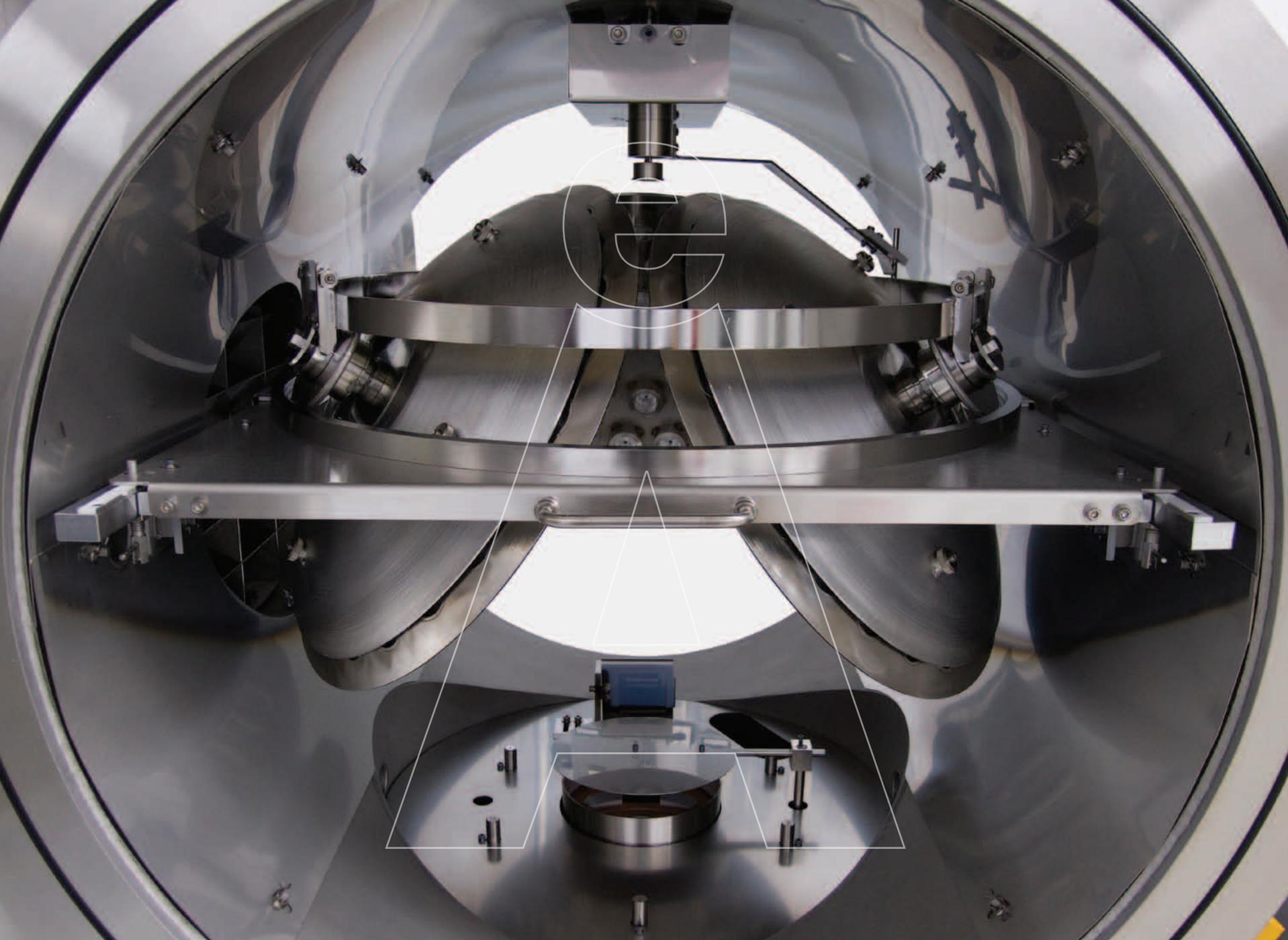




**e**  
**A** **ANGSTROM**  
ENGINEERING



## ***The Advantage of ANGSTROM ENGINEERING***

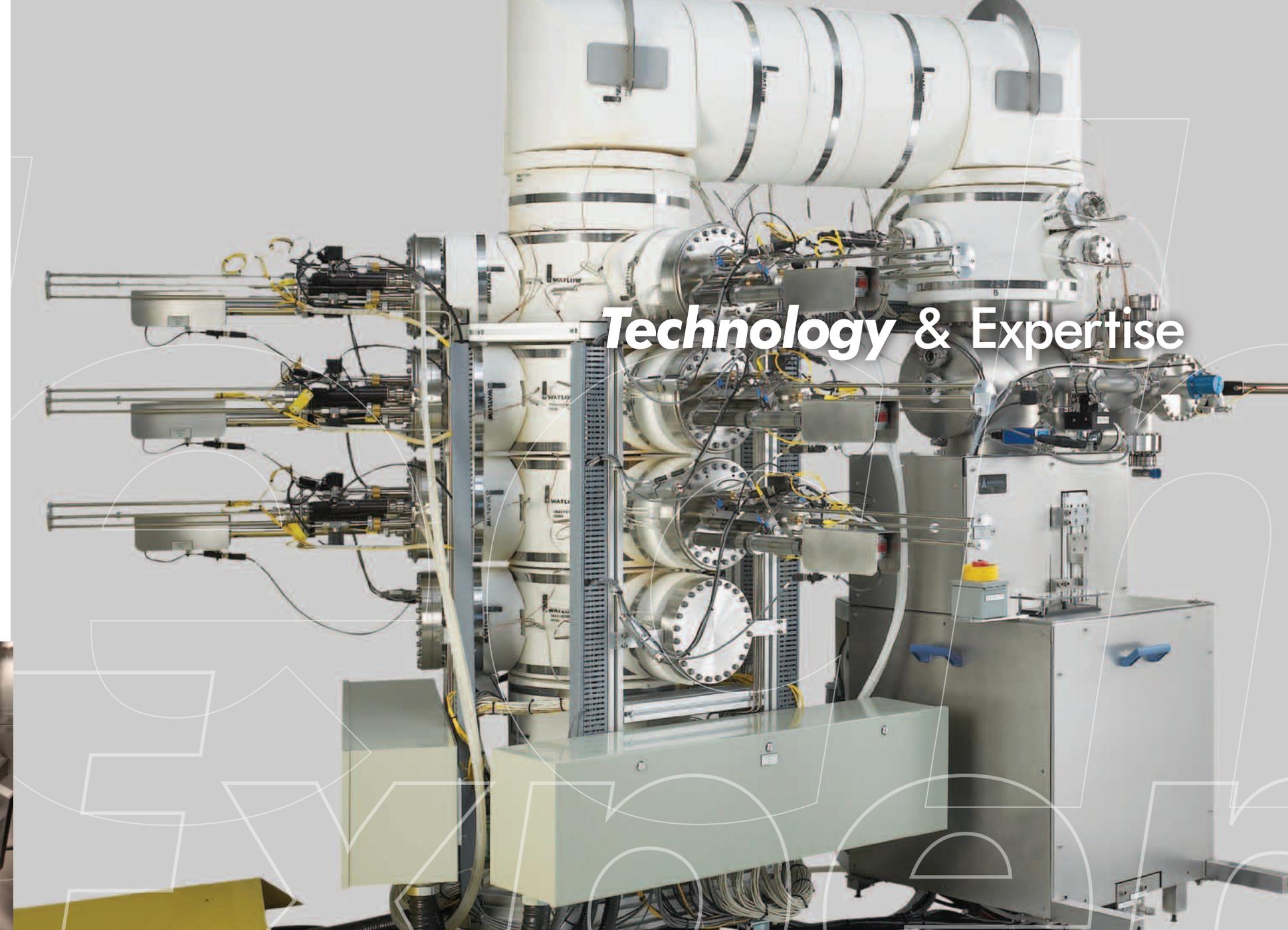
When your vacuum product demands go beyond the scope of basic shelf equipment, our knowledgeable team is ready to create and manufacture a system to meet your needs. We specialize in custom design and offer modular products with unique configuration flexibility. From design to manufacturing, delivery to ongoing support, our value, expertise and workmanship is unparalleled.

***“We have several labs with over \$2,000,000.00 of equipment from 30+ vendors and Angstrom Engineering has the best customer service.”***

*—Dr. Thuc-Quyen Nguyen, University of California, Santa Barbara*

## **Thin Film** Introduction

Thin film deposition includes a list of technologies associated with growing layers of materials on a substrate with thicknesses from less than 1 nm to several microns. Angstrom Engineering offers abundant applications of these technologies, including in the fields of renewable energy, organic electronics, flat panel displays, optical, tribological, optical/magnetic storage and hard/decorative coatings.



***“Out of all the systems I have used, yours is by far the most reliable, consistent and easy to use.”***

—Dr. Marc Baldo, MIT

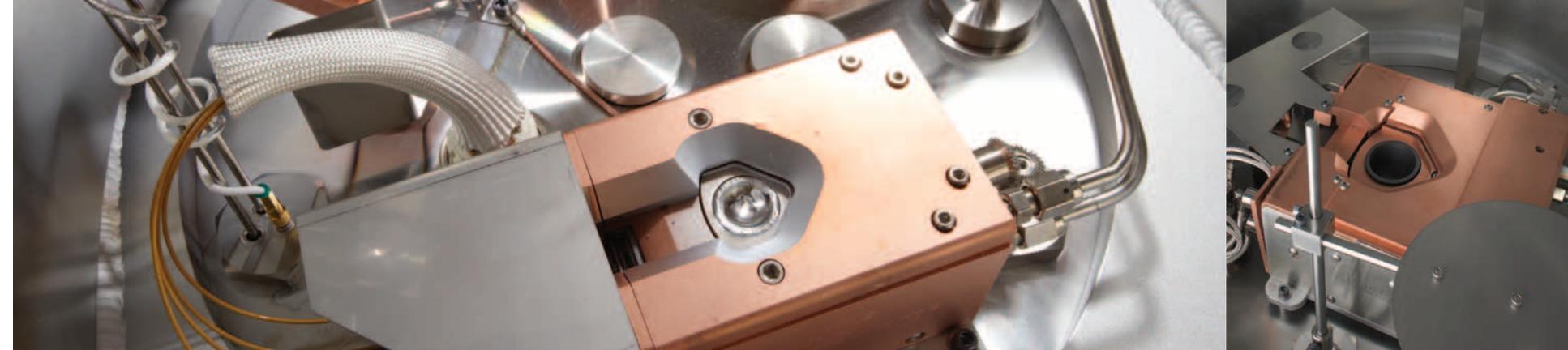
## Resistive Thermal Evaporation

Resistive evaporation is a vacuum deposition process that uses electrical energy to heat a filament, which in turn heats deposition material to the point of evaporation. The process can be performed at very high levels of vacuum allowing for a long mean free path and therefore,

fewer opportunities to introduce film impurities. High deposition rates can be achieved and lower energy particles can reduce substrate damage.

Angstrom Engineering has developed thin film deposition systems based on this technique which can deposit a wide

range of materials including: metals, organic polymers and inorganic polymers. The process can be controlled using QCM, temperature or optical monitoring systems ensuring consistent, high-quality results.

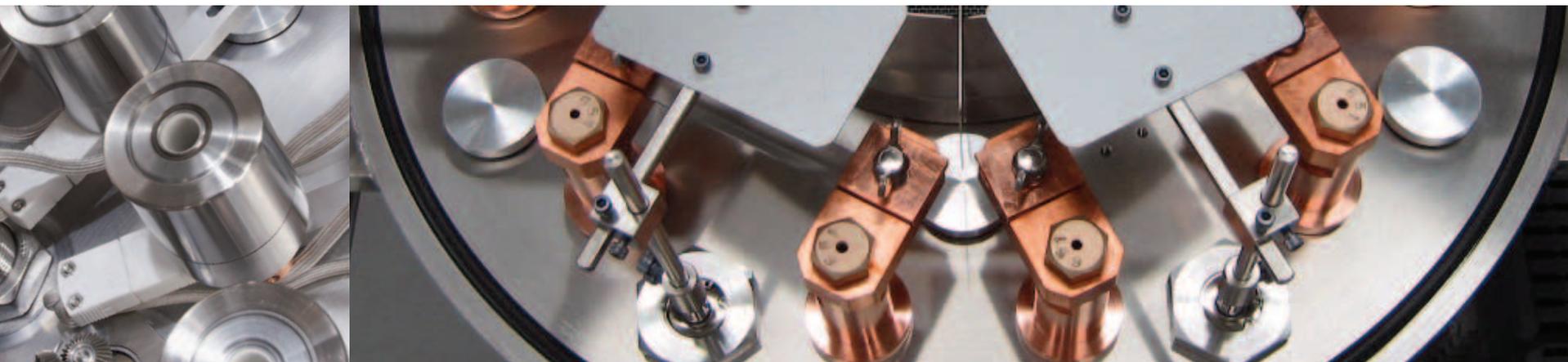


## Electron Beam Evaporation

In electron beam evaporation, a filament emits a magnetically focused, high energy beam of electrons which is swept within a crucible of deposition material. Large capacity pockets and multi-pocket indexing designs allow greater film thickness and an increase in process runs before breaking the vacuum to load material.

High melting point materials can be deposited at high deposition rates, making this a preferred process for refractory metal and ceramic films. A vaporized deposition material may retain a “skin” of unmelted material, protecting the crucible from corrosion or contamination in highly reactive materials.

Angstrom Engineering incorporates electron beam deposition into systems, providing advanced beam sweep pattern control for the most difficult applications. Systems can be configured using our standard platform designs or custom-designed to meet your specifications.



## Sputter Deposition

In sputtering, the impact of high energy particles contained in a plasma eject atoms from the surface of a target material. These ejected atoms condense on the surface of the substrate to create a thin film. Sputter deposition operates at higher pressures than evaporation, lowering the mean free path

and allowing reactions to take place. Sputtered films have stoichiometry that better represents the target material than does an evaporated film. Certain processes will benefit from improved film adhesion due to higher impact energy. Sputter targets and sources can be sized to optimize rate, throughput and

film thickness uniformity. Angstrom Engineering's sputter deposition technology incorporates the highest quality sputter deposition sources with a gas pressure control system that allows multi-gas inlets, high gas ratios, reactive gases and more.



## Ion Assisted Deposition

In IAD, a broad beam ion source directs a dispersed ion beam with a range of ion energies toward the substrate, typically along with a sputter or electron beam source. An inert gas such as Ar or reactive gases such as O<sub>2</sub> and N<sub>2</sub> can be used to provide additional chemical reactions during film growth. IAD processes allow advanced process

film growth through surface reactions, film density control and improved adhesion. Let Angstrom Engineering improve your process capabilities by adding an ion source to your process. Our software solutions allow for precise control of these elaborate, simultaneous processes.

***“The system design is conducive to low compositional variability within the film and from run to run.”***

—Dr. Shiva Prakash, *DuPont Displays*



## Glove Box Integration

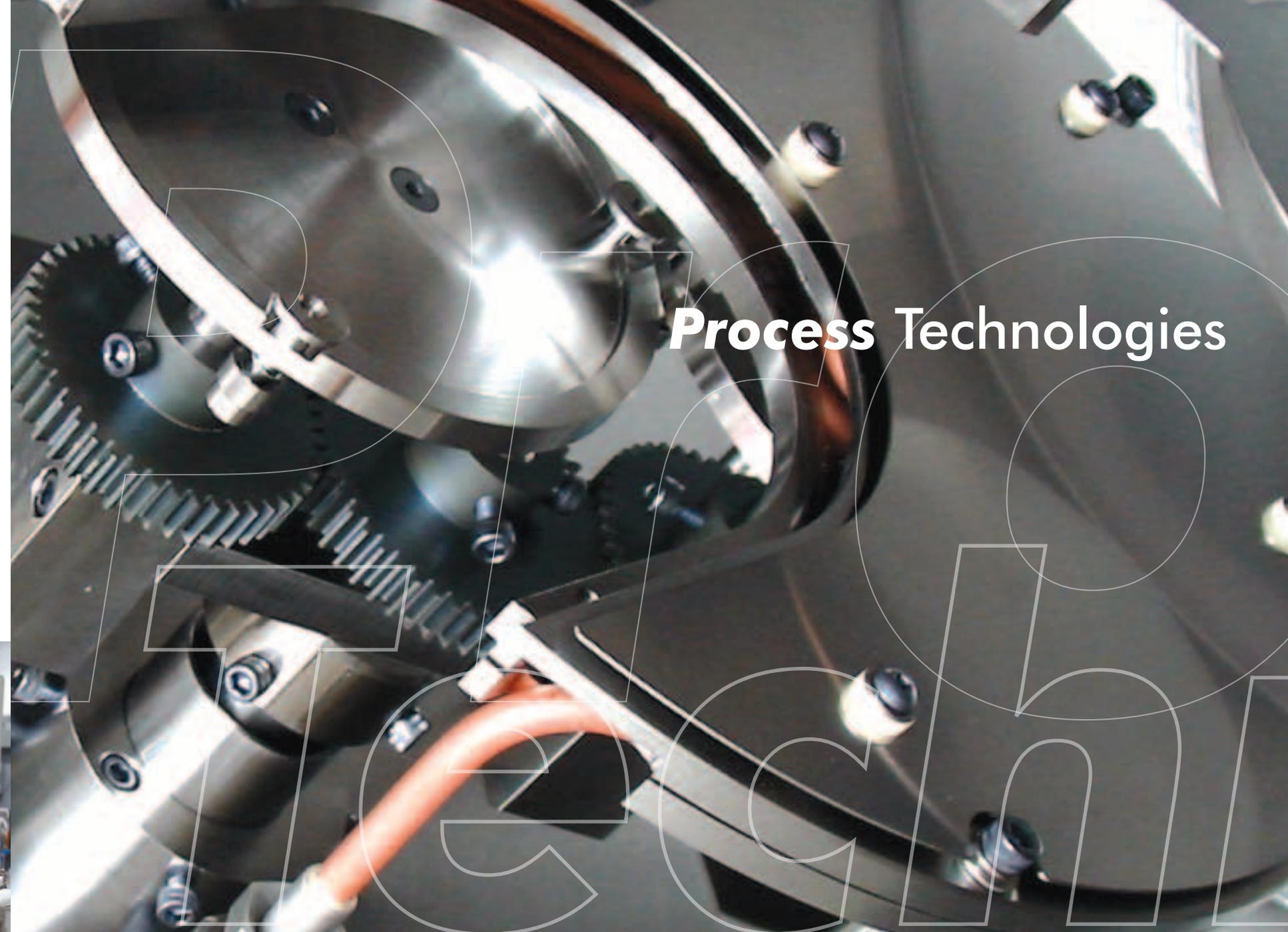
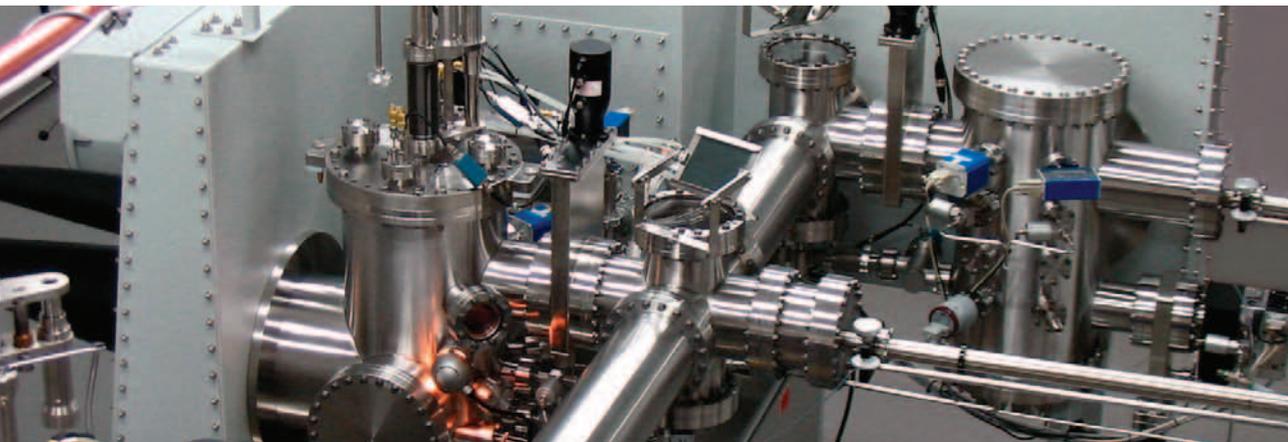
Angstrom Engineering is a leader in solving PVD process challenges by using the controlled atmosphere of a glove box. This total system integration allows non-PVD and PVD processes to be connected within a controlled

environment. The integrated system allows sensitive materials and substrates to be stored, then moved from process to process and tested without exposure to the room environment. With a focus on system usability

and accessibility, Angstrom Engineering is ready to configure a complete system to meet your space and application requirements.

***“From the time it was delivered, this laboratory system has performed nearly flawlessly, arguably extending our capabilities well beyond those currently attainable by any organic thin film laboratory in the world.”***

—Dr. Stephen Forrest, *University of Michigan*



## Substrate Temperature Control

Improved grain boundary migration, post process annealing and controlling surface reactions are just a sampling of the applications for substrate temperature control. For your heating or cooling applications we have several standard options and the ability to customize a solution for your substrate and temperature range.

## Biasing

If you are looking to control film density or improve adhesion, a bias may be the solution. Angstrom Engineering can configure many of our stages to include a DC or RF bias.



## Planetary Motion

Our planetary stage fixturing allows improved uniformity over a large number of substrates. Typically reserved for our Åmod and EvoVac lines, planetary fixturing can substantially increase your system throughput.

## Substrate Cleaning

In-situ cleaning via ion beam or glow discharge ensures your substrate is prepared for deposition. For removal of native oxides to residual oils, consider adding a cleaning process to your system.



**Our** Products

Angstrom Engineering was founded on the basis of custom engineering. Every vacuum system product we develop has the advantage of flexibility when configuring your ideal process solution.

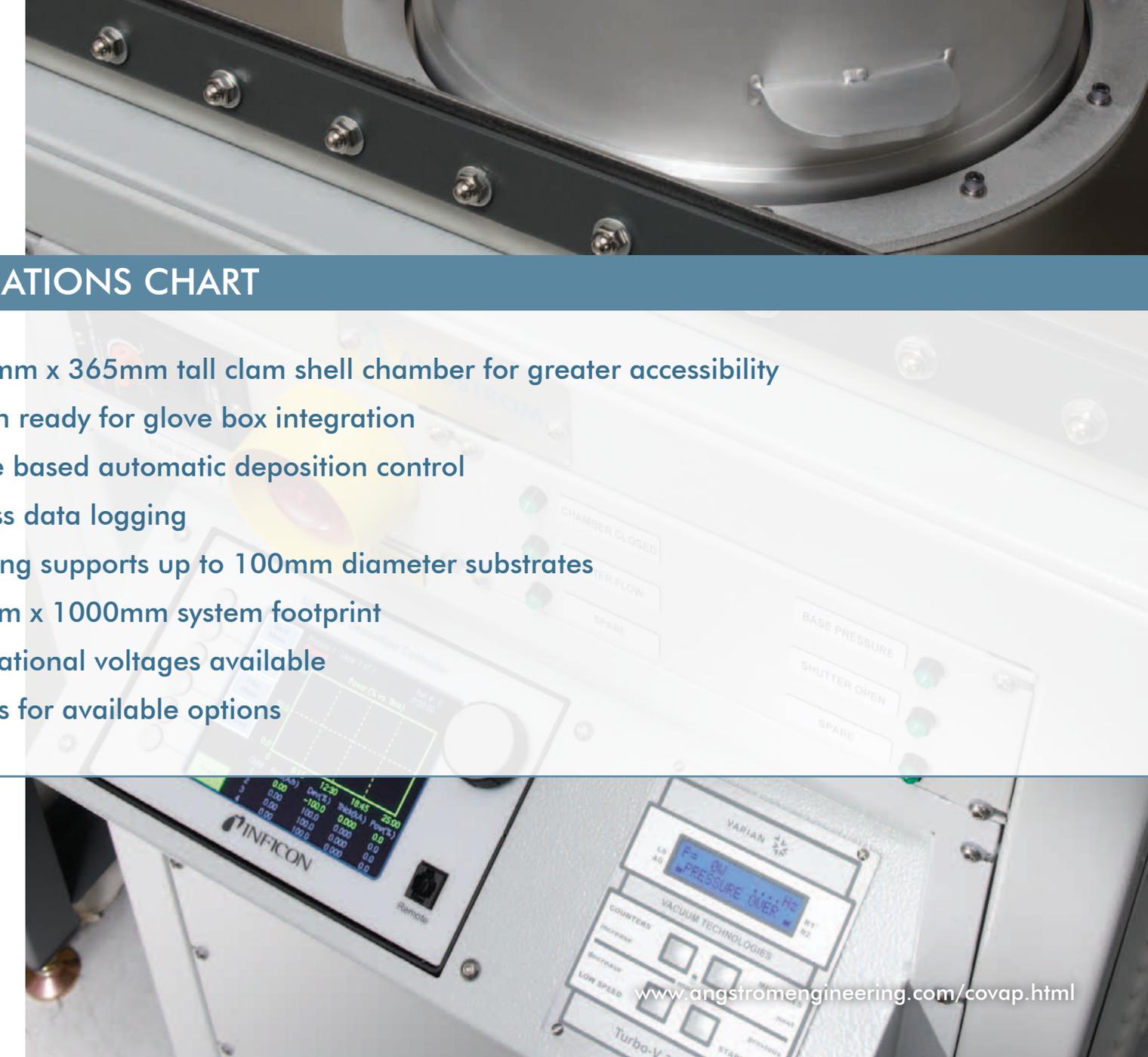
## Covap II Series

The Covap II series offers a compact, economical solution suitable for many process applications. Its small size will ensure you will find space in your lab and your budget. Built to our high quality standards, the Covap II is available with closed loop co-deposition control, recipe storage and a unique clam-shell chamber for improved accessibility. If your process requires controlled atmosphere integration, the Covap II is design ready to be built into a new or existing glove box.



### SPECIFICATIONS CHART

- $\varnothing$ 300mm x 365mm tall clam shell chamber for greater accessibility
- Design ready for glove box integration
- Recipe based automatic deposition control
- Process data logging
- Fixturing supports up to 100mm diameter substrates
- 600mm x 1000mm system footprint
- International voltages available
- Call us for available options



## Nexdep Series

The Nexdep system can be built to your needs with custom flexibility, in a compact footprint and at an economical price. Whether your process requires resistive evaporation, sputter deposition or electron beam evaporation, the Nexdep is highly capable. With its large, hinged front door, working with and cleaning the machine couldn't be easier.



### SPECIFICATIONS CHART

- $\varnothing$ 400mm x 475mm tall D-shaped chamber with large hinged front door
- Aluminum or stainless steel chamber options
- Recipe based automatic deposition control
- Process data logging
- Support for multiple PVD processes
- 600mm x 1000mm system footprint
- International voltages available
- Custom designed to meet your process requirements

## Åmod Series

The Åmod line of thin film deposition tools was designed to meet the advanced process requirements of today's thin film research. Our flagship line is fully customizable and can even be combined as part of a multi-system configuration. Our in-house developed control software smoothly integrates various system components, keeping the right information at your fingertips.



### SPECIFICATIONS CHART

- Angstrom advanced PC based software control system
- Process data logging
- Design ready for glove box integration
- 475mm x 475mm x 500mm tall chamber with sliding and hinged door options
- Support for multiple PVD processes
- 1600mm x 1000mm system footprint
- International voltages available
- Custom designed to meet your process requirements

## EvoVac Series

Expanding on the popularity of our Åmod line the EvoVac's larger size allows even more configuration flexibility. Glove box integration is improved with its wider door opening and an increased chamber height allows for a greater source to substrate distance. The EvoVac line is for the researcher looking for more sources and flexibility in a deposition system.



## SPECIFICATIONS CHART

- Angstrom advanced PC based software control system
- Process data logging
- Design ready for glove box integration
- 660mm x 660mm x 500mm deep chamber for increased source to substrate distances
- Support for multiple PVD processes
- 1600mm x 1000mm system footprint
- International voltages available
- Custom designed to meet your process requirements

## ***Your Partner*** for PVD Equipment Solutions

Angstrom Engineering designs and manufactures thin film deposition tools for both the research and commercial sectors. Founded in 1992, Angstrom Engineering Inc. has gained recognition as a customer focused, solution driven engineering and manufacturing corporation.

Today Angstrom Engineering has grown into an internationally recognized supplier of PVD thin film equipment while maintaining our commitment to providing an exceptional customer experience.

[www.angstromengineering.com](http://www.angstromengineering.com)