Thin Film and Vacuum R&D Systems

range of products

the high-tech choice
Kenosistec—your first choice when you need customized and flexible solutions to develop your ideas.

**Range of Products**
- PVD Systems
  - Sputtering Equipment
  - Evaporation Systems
  - Cathodic Arc Equipment
- RIE/PECVD Systems
- ALD and PLD Systems
- Combined technologies and Cluster Systems
- Scale up: from Lab to Intermediate or Large Area Systems
- Gas Sensor Test Systems
- Cathodes, Power Supplies and Vacuum Components

**Services**
- Process development
- Commissioning, Training and After Sales

**Skills and strategy**
Since 1968 Kenosistec has become the reference for high quality R&D coating systems and customized applications.

As a result of its continuous improvement efforts, the company combines its extensive experience with flexibility, reliability and competitive prices. Kenosistec establishes strong and active collaborations with its customers, public and private, developing together fully customized equipment.

**Application fields**
- Semiconductor (MEMS, Microelectronics, Batteries, PV, Optoelectronics...)
- Devices (OLEDs, Sensors, Flexible displays...)
- Optics (Lenses, Filters, Spectrally selective coatings...)
- Tribology (Tools, Moulds, Valves, Turbines...)
- Wetting (Textiles, Glasses...)
- Biomedical science (Prosthetics, valves, stents, biometric sensors...)
- Decorative (Faucets, plastics, jewellery, cutlery...)
- Interior and exterior automotive components

**Materials**
- Nanostructured materials
- Perovskites
- Graphene
- Cermet
- Nano Composites
- Superconductors
- DLC
- Metals
- Others
Sputtering Equipment

Kenosisteck Sputtering Systems (KS) can be horizontal, vertical and confocal.

- **Horizontal and Vertical** configurations are optimized for multilayer depositions of single materials. Horizontal is more flexible in terms of substrates handling. Vertical avoids getting target’s flakes on the substrates and allows to coat 3D samples, using a double (or triple) rotation samples holder.

- **Confocal** configuration (Sputter-up or Sputter-down) allows to obtain real alloys by co-depositing materials from different targets.

In addition, each system can be equipped with a load lock capable of loading a single sample or samples cassette.

### Pumping System
- Cryo and/or Turbo

### Ultimate vacuum
- 3x10⁻⁷ mbar (10⁻⁷⁻¹⁰⁻⁹ mbar range for UHV models)

### Substrate Heating
- up to 800°C

### Substrate Blasting/Cleaning
- DC, DC pulsed, RF

### Power Supplies available for sources
- DC, DC pulsed, RF, HiPIMS, MF (AC or Bi-Pulsed)

### Horizontal Sputtering

<table>
<thead>
<tr>
<th>Model</th>
<th>KS 400 In-Line</th>
<th>KS 800 In-Line</th>
<th>KS 600 HR</th>
<th>KS 800 HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamber dimension</td>
<td>W 400 - H 250 L 1700 mm</td>
<td>W 800 - H 250 L 2500 mm</td>
<td>Ø 600 mm h 450 mm</td>
<td>Ø 800 mm h 450 mm</td>
</tr>
<tr>
<td>Sample max size</td>
<td>200x300 mm</td>
<td>505x700 mm</td>
<td>n. 4 - Ø 6”</td>
<td>n. 4 - Ø 8”</td>
</tr>
<tr>
<td>Max number of rectangular/circular Cathodes</td>
<td>n. 4 - 12” x 3”</td>
<td>n. 5 - 22” x 5”</td>
<td>n. 4 - Ø 4”</td>
<td>n. 4 - Ø 8”</td>
</tr>
<tr>
<td>Substrate Holder</td>
<td>Linear movement</td>
<td>Linear movement</td>
<td>Single or double rotation</td>
<td>Single or double rotation</td>
</tr>
</tbody>
</table>

### Vertical Sputtering

<table>
<thead>
<tr>
<th>Model</th>
<th>KS 500 V</th>
<th>KS 800 V</th>
<th>KS 1000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamber dimension</td>
<td>Ø 500 - h 600 mm</td>
<td>Ø 800 - h 800 mm</td>
<td>Ø 1000 - h 1100 mm</td>
</tr>
<tr>
<td>Maximum carousel diameter</td>
<td>Ø 400 mm</td>
<td>Ø 700 mm</td>
<td>Ø 850 mm</td>
</tr>
<tr>
<td>Max number of rectangular Cathodes</td>
<td>n. 3 - 12” x 3”</td>
<td>n. 4 - 16” x 5”</td>
<td>n. 6 - 32” x 5”</td>
</tr>
<tr>
<td>Substrate Holder</td>
<td>Single or double rotation</td>
<td>Single or double rotation</td>
<td>Single or double rotation</td>
</tr>
</tbody>
</table>

### Confocal Sputtering

<table>
<thead>
<tr>
<th>Model</th>
<th>KS 400 C</th>
<th>KS 500 C</th>
<th>KS 800 C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamber dimension</td>
<td>Ø 400 - h 400 mm</td>
<td>Ø 500 - h 600 mm</td>
<td>Ø 800 - h 600 mm</td>
</tr>
<tr>
<td>Sample max size</td>
<td>n. 1 - Ø 6”</td>
<td>n. 1 - Ø 8”</td>
<td>n. 1 - Ø 10”</td>
</tr>
<tr>
<td>Max number of circular Cathodes</td>
<td>n. 4 - Ø 2” or 3”</td>
<td>n. 2 - Ø 6”</td>
<td>n. 4 - Ø 4”</td>
</tr>
<tr>
<td>Substrate Holder</td>
<td>Single rotation</td>
<td>Single rotation</td>
<td>Single rotation</td>
</tr>
</tbody>
</table>
Evaporation Systems

Kenosistec Evaporation Systems (KE) have a cylindrical or cubic process chamber that can be fitted with several deposition sources: thermal, effusion cells (specifically designed for perovskites and organic materials) and e-beam sources. Their number is limited only by the available space in the chamber. The equipment can be provided with double rotation, flat, or dome substrates holder.

Possible Features:
- Co-evaporation
- Heating of the substrates holder up to 800°C
- Ion Beam Etching and Ion Beam ASSISTED DEPOSITION.

A Load-Lock chamber can be added for speeding up chamber loading, samples pre-heating and/or for plasma treatment.

<table>
<thead>
<tr>
<th><strong>EVAPORATOR</strong></th>
<th><strong>KE 300 ETI</strong></th>
<th><strong>KE 500 ETI</strong></th>
<th><strong>KE 1000 ETI</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamber dimension</td>
<td>Ø 300 - h 400 mm</td>
<td>Ø 500 - h 600 mm</td>
<td>Ø 1000 - h 1100 mm</td>
</tr>
<tr>
<td>Sample max size</td>
<td>1 of Ø 6&quot; or 8&quot;</td>
<td>1 of Ø 6&quot; or 8&quot; (planetary configuration) or Dome up to Ø 400 mm</td>
<td>8 samples of Ø 6&quot; (planetary configuration) or Dome up to Ø 900 mm</td>
</tr>
<tr>
<td>E-Beam power source</td>
<td>up to 6 kW</td>
<td>up to 10 kW</td>
<td>Single or Twin up to 10 kW</td>
</tr>
</tbody>
</table>

Through-the-Wall

Special Design for Clean Room installation
**Cathodic Arc Equipment**

Kenosistec Cathodic Arc Systems (KA) are designed to deposit functional or decorative coatings on a lab scale. The chamber is water cooled and it can be provided with single or double rotation substrates holder, to coat flat or 3-D samples.

- Substrates can be heated up to 400°C
- Substrates holder insulated for Biasing and Plasma cleaning
- Arc sources 63 mm or 100 mm diameter (own design)

Optional Plasma Ion Source for non-conductive substrates cleaning.

**RIE/PECVD System**

**Reactive Ion Etching** equipment are designed for high-resolution dry etching and it is suitable for high uniformity processes. It can be set for working with inert and reactive gases for etching SiO2, Al2O3, Au, Cr2O3, Al, MoSi2, TaSi2, GaAs.

It can be used as a small production unit with a capability of 10-40 wafers per hour and it is especially suitable for irregular shapes.

The substrate holder is connected to RF power supply. Gas distribution ring and Pyrex cylinder guarantees: a uniform gas flow at the surface and a good plasma confinement.

The substrate holder can be designed to etch samples with different sizes (from 2” up to 8” diameter) and can be heated up to a maximum of 300°C and cooled down to a minimum of -20°C.

**PECVD** equipment is designed for materials such as SiO2 at high deposition rate, starting from a liquid precursor injected in the chamber in vapour phase. Our System can be equipped with an Inductively or Capacitive Coupled RF-sources according to customer requirements.

In case of Capacitive coupled sources, deposition can be Anode or Cathode driven. Bubbler or Vapour sources with controlled flow system can be used in order to get a stable deposition rate. Substrate maximum dimensions 300x300 mm and, as an option, it can be cooled.

Customized or large area equipment for more specific applications can be designed according to customer needs.
**ALD/PLD System**

**Atomic Layer Deposition** is a technique that allows to deposit a material by a sequence of single atomic layers with a very accurate uniformity and high density. Kenosistec developed its own design ALD based on customer specific process and requirements. Commercial ALD can be integrated in customized solution to be offered as a turnkey equipment.

**Pulsed Laser Deposition** is a deposition technique specifically designed to operate in a UHV environment. The deposition material is eroded by a laser from a target. Target motion is the result of the real time composition of a rotary and a translation motion. Kenosistec developed a special randomizing function, optimized to avoid orbit overlapping. This function assures an even distribution of the laser energy for any given set of parameters. Repetition rate and spot size can be adjusted in real time during a deposition run. The latter feature can be very useful when optimizing ablation condition for a new material. The software control assures uniform target consumption for any given target size or material (solid, frozen liquid or sintered). The sample handling is, as well, controlled by a multiple axis system. A load lock for target and/or samples can be integrated into the equipment. Each system can be equipped with an in-situ monitoring as, for example, a RHEED.

**Combined Technologies Systems**

Kenosistec designed many equipment where different deposition technologies were combined together. The strength of such idea is to put together the advantages and peculiar properties of each deposition technique in order to reach the best possible coating performances.

Possible configurations and their application field:

- **HiPIMS, DUAL magnetron sputtering with Cathodic Arc Evaporation Sources;** especially designed to offer the best results for tribology coatings.
- **Sputtering, Thermal and E-beam evaporation;** great results for optics and microelectronic field.
- **Sputtering and PECVD;** fine properties of PVD film and an AR-protective layer.
- **Sputtering and PLD;** increased performance of standard sputtering by adding higher density layers of different materials.
- **ALD, PLD Etching and Sputtering;** Microelectronic, Nanosensors, Mems.
Cluster

Cluster is a Multi-chamber system where samples run from a chamber to another. Each chamber can be equipped with its own technology (such as sputtering and/or evaporation and/or plasma cleaning). A possible configuration is represented by KS 800 Cluster:

- Automatic Load-Lock chamber with parking station for samples fast loading
- Transfer Chamber to move samples across chambers
- Etch/Plasma cleaning chamber for samples cleaning/etching
- Confocal sputtering chamber to deposit metallic materials
- Confocal sputtering chamber to deposit oxide materials

The advantage of such design is to keep each process separated in order to avoid cross contamination. As a further plus, each chamber can be designed to meet process specific requirements. A cassette-to-cassette load lock is connected to a transfer-park module from which the samples can be moved to the process chambers.

Scale-up from Lab to Intermediate or Large Area Systems

Kenosistec is capable to help the customer on scaling-up their process from Lab scale to a larger area, providing technical solutions, engineering and equipment manufacturing.
Gas Sensor Test System

Gas Sensor Test is a system designed to reproduce specific conditions for testing Gas Sensors Devices.

The system can tune the following parameters:
• Gas concentration down to 10 ppb
• Dry and/or wet gas mixtures
• Humidity control from 0 to 95%
• Standard Temperature control from 5 to 45°C

The system allows an extremely high accuracy and repeatability. A volumetric mixture is prepared by mass-flow-controllers (MFCs with an appropriate range) starting from pure gases. The system can include a dry-air line, a wet-air line and dry-gases lines. Those lines are made of stainless steel with metal seal in order to avoid water vapor permeation and gas surface adsorption. As an option, a mass spectrometer can be included to check gases concentration, to evaluate reproducibility, contamination and system leak.

V-See Software

V-See is a user-friendly supervisor for controlling PLC and instruments network architecture. It runs on Windows Operative System. The Main logic is resident in the PLC; The equipment status is continuously monitored and each cycle data is stored in the PC memory. The Software is very flexible and allows to choose and change all possible parameters (gas flows, power, rotation speed, etc...) even in automatic way. Recipes are built-in with a large number of sequential steps, they are easy to recall and intuitive to create and modify.

Remote servicing is possible to assist our customers.

PLC - Programmable Logic Controller

Simatic S7-Series PLC and TIA Portal or customized solutions.

Their main characteristics are:
• High performance
• High speed signal processing
• Extensive system functions
• Great reliability
• Safety interlocks
Magnetron Sources

- Possibility to work in DC, DC Pulsed, RF and HiPIMS mode
- Target water cooling, direct or indirect
- Anti cross-contamination shield, dark space shield and clamp with screws for easy target change
- Target thickness ranges from 1 to 6.35 mm (with proper clamp)
- Magnet array for conductive and insulating materials or ferromagnetic materials (pre-configured)
- HV or UHV range (pre-configured)
- Internal or external mount (pre-configured)
- Operating Pressure from 2 x 10^-3 mbar to 2 x 10^-2 mbar

Circular Magnetrons

- Circular Magnetron standard target size 2", 3" or 4" (larger on request)
- Tilt 0 - 25° and Gas Ring (Optional)
- Diode Version Available

<table>
<thead>
<tr>
<th>MAIN FEATURES</th>
<th>2&quot; target</th>
<th>3&quot; target</th>
<th>4&quot; target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Power (direct cooling)</td>
<td>DC, DC pulsed, HiPIMS:</td>
<td>400 W</td>
<td>800 W</td>
</tr>
<tr>
<td></td>
<td>RF:</td>
<td>200 W</td>
<td>400 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAIN FEATURES</th>
<th>2&quot; target</th>
<th>3&quot; target</th>
<th>4&quot; target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Power (indirect cooling)</td>
<td>DC, DC pulsed, HiPIMS:</td>
<td>250 W</td>
<td>500 W</td>
</tr>
<tr>
<td></td>
<td>RF:</td>
<td>100 W</td>
<td>200 W</td>
</tr>
</tbody>
</table>

Rectangular Magnetrons

- Rectangular Magnetron Standard target size 8"x 3", 12"x 3", 16"x 5", 22"x 5", 43"x 5"
- Other dimensions on demand

<table>
<thead>
<tr>
<th>MAIN FEATURES</th>
<th>Max Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct cooling</td>
<td>DC, DC pulsed, HiPIMS:</td>
</tr>
<tr>
<td></td>
<td>RF:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAIN FEATURES</th>
<th>Max Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect cooling</td>
<td>DC, DC pulsed, HiPIMS:</td>
</tr>
<tr>
<td></td>
<td>RF:</td>
</tr>
</tbody>
</table>

CAE Cathodic Arc Evaporation Sources

- Cathode diameter: 63 or 100 mm
- Up to 250 A
- Arcs ignition trigger (own design)
- Fast Protection in case of trigger short circuit (i.e. trigger melted to the target)
- Special dark space shield for droplets reduction
- Target easy mounting;
  Cost effective targets manufacturing
  Effective erosion of the targets

Mounting those sources in an array configuration, it is possible to deposit on a large area. In this configuration each source can be set independently in order to tune uniformity.

Power Supplies

<table>
<thead>
<tr>
<th>MAIN FEATURES</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC (air cooled)</td>
<td>500 W (1000V - 1A)</td>
</tr>
<tr>
<td>RF (air cooled) and Matching Network (automatic)</td>
<td>200 W</td>
</tr>
<tr>
<td></td>
<td>300 W</td>
</tr>
<tr>
<td></td>
<td>400 W</td>
</tr>
<tr>
<td></td>
<td>750 W</td>
</tr>
<tr>
<td>Arc Generator (for CAE sources air cooled)</td>
<td>150 A</td>
</tr>
<tr>
<td></td>
<td>250 A</td>
</tr>
</tbody>
</table>
Vacuum Components

- Manipulators (manual and motor drive motion)
- Heaters
- Vacuum transfer vessels
- Feedthrough
- Special flanges
- Viewports
- Cryo-traps
- High purity gas distribution system

Services

Process development

Kenosistec is able to translate customer needs, in terms of processes, into technical solutions, in terms of engineering, design and/or system scale-up.

Some basic coating properties can be tested and measured in house laboratory or at partners lab. Available instruments:
- UV-VIS-NIR Spectrophotometer (200 - 2500 nm)
- Profilometer
- Colorimeter
- Glossmeter
- Optical Microscope
- 4 Point Probe
- Ball-cratering

Commissioning, training and after sales

Kenosistec offers a global support network able to guarantee to its customers 24-hour availability, spare parts and fast delivery.

Kenosistec offers an extensive training service in house or at customer site.

Remote assistance:
If an internet connection is available at customer site, our software engineer can check their system status in real-time performing software changes based on any further requests from the customer.
Angelantoni Group has always been a hub of innovation thanks to its collaboration with research institutes and universities, which has led to the design, manufacture, and marketing of state-of-the-art products in diverse application fields and the registration of a significant number of patents.

Since its beginning in 1932, numerous challenges have been met and won, with a focus on offering innovative solutions, providing customers with ingenious products and tailored services, and assisting them in the best possible way.

www.angelantoni.com
Kenosistec, owned by Angelantoni Group, is a company capable to offer a wide range of systems for thin film deposition. Passion, technical competences, experience are the basis for offering innovative and competitive solutions for research, industrial and large area coating processes. Our leadership in this market is based on high quality products. New solutions and new improvements are constantly promoted in order to satisfy our customer needs. We are committed to respect and value the environment.