KENOSISTEC | PVD GREEN EVOLUTION

Angelantoni TECHNOLOGY FOR LIFE

Thin Film and Vacuum R&D Systems range of products

the high-tech choice

kenosistec.com

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

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Equipment for customized applications

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.

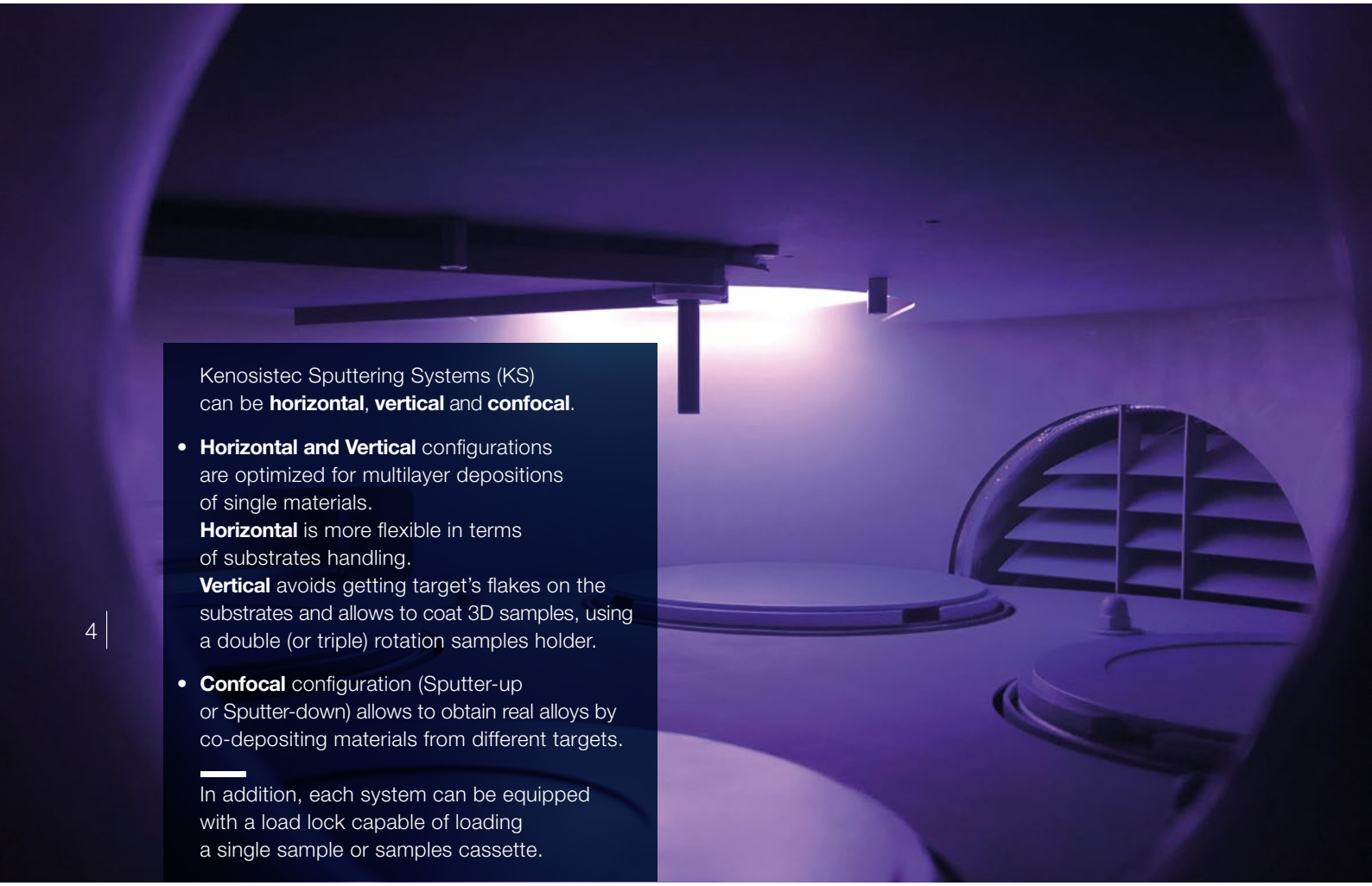
Application fields

- Semiconductor (Mems, Microelectronics, Batteries, PV,Optoelectronics...)
- Devices (Oled, Sensors, Flexible displays,...)
- Optics (Lenses, Filters, Spectrally selective coatings...)
- Tribology (Tools, Moulds, Valves, Turbines,...)
- Wetting (Textiles, Glasses,
- Biomedical science (prosthesis, valves, stent, 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



Kenosistec 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^{-8}-10^{-9} mbar range for UHV models)
Substrate Heating	up to 800°C
Substrate Biasing/Cleaning	DC, DC pulsed, RF
Power Supplies available for sources	DC, DC pulsed, RF, HiPIMS, MF (AC or Bi-Pulsed)

HORIZONTAL SPUTTERING	KS 400 In-Line	KS 800 In-Line	KS 600 HR	KS 800 HR
Chamber dimension	W 400 - H 250 L 1700 mm	W 800 - H 250 L 2300 mm	Ø 600 mm h 450 mm	Ø 800 mm h 450 mm
Sample max size	200x300 mm	500x700 mm	n. 4 - Ø 6”	n. 4 - Ø 8”
Max number of rectangular/ circular Cathodes	n. 4 - 12” x 3”	n. 5 - 22” x 5”	n. 4 - Ø 4”	n. 4 - Ø 8”
Substrate Holder	Linear movement	Linear movement	Single or double rotation	Single or double rotation

VERTICAL SPUTTERING	KS 500 V	KS 800 V	KS 1000 V
Chamber dimension	Ø 500 - h 600 mm	Ø 800 - h 800 mm	Ø 1000 - h 1100 mm
Maximum carousel diameter	Ø 400 mm	Ø 700 mm	Ø 850 mm
Max number of rectangular Cathodes	n. 3 - 12” x 3”	n. 4 - 16” x 5”	n. 6 - 32” x 5”
Substrate Holder	Single or double rotation	Single or double rotation	Single or double rotation

CONFOCAL SPUTTERING	KS 400 C	KS 500 C	KS 800 C
Chamber dimension	Ø 400 - h 400 mm	Ø 500 - h 600 mm	Ø 800 - h 600 mm
Sample max size	n. 1 - Ø 6”	n. 1 - Ø 8”	n. 1 - Ø 10”
Max number of circular Cathodes	n. 4 - Ø 2” or 3”	n. 2 - Ø 6” n. 4 - Ø 4”	n. 2 - Ø 8” n. 4 - Ø 6” n. 6 - Ø 4”
Substrate Holder	Single rotation	Single rotation	Single rotation

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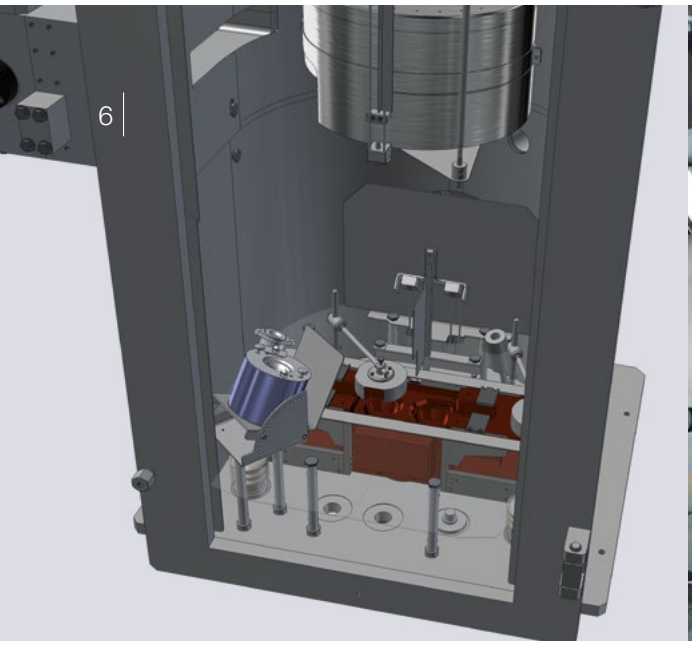
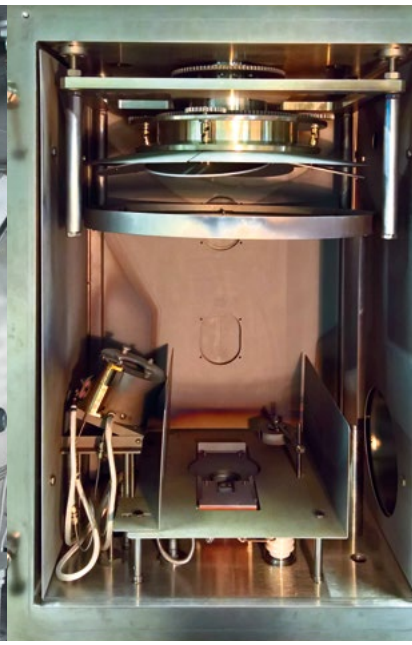
Evaporation Systems

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."

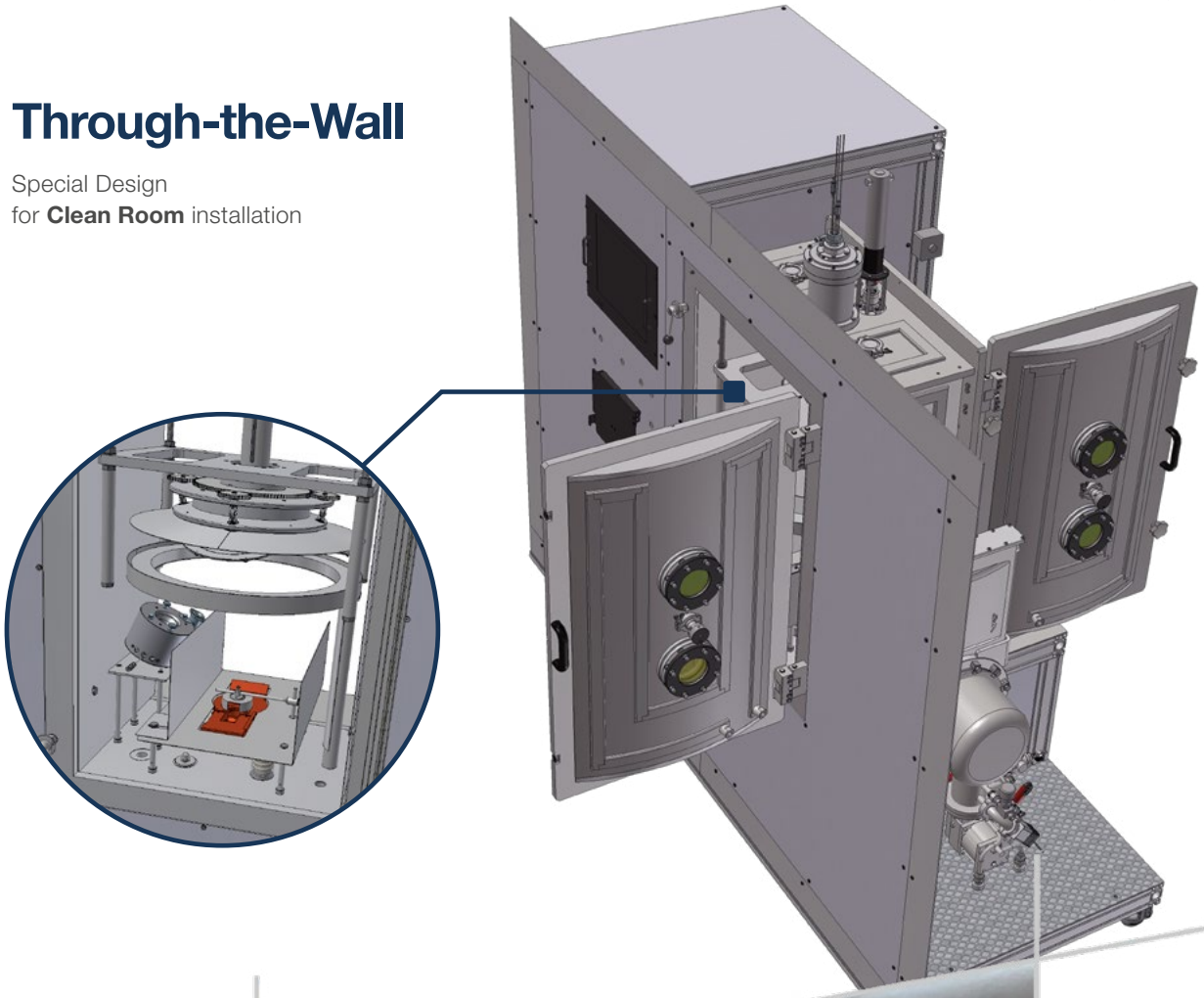




EVAPORATOR	KE 300 ETI	KS 500 ETI	KE 1000 ETI
Chamber dimension	Ø 300 - h 400 mm	Ø 500 - h 600 mm	Ø 1000 - h 1100 mm
Sample max size	1 of Ø 6"or 8"	1 of Ø 6"or 8" or 4 samples of Ø 4" (planetary configuration) or Dome up to Ø 400 mm	8 samples of Ø 6" (planetary configuration) or Dome up to Ø 900 mm
E-Beam power source	up to 6 kW	up to 10 kW	Single or Twin up to 10 kW

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.

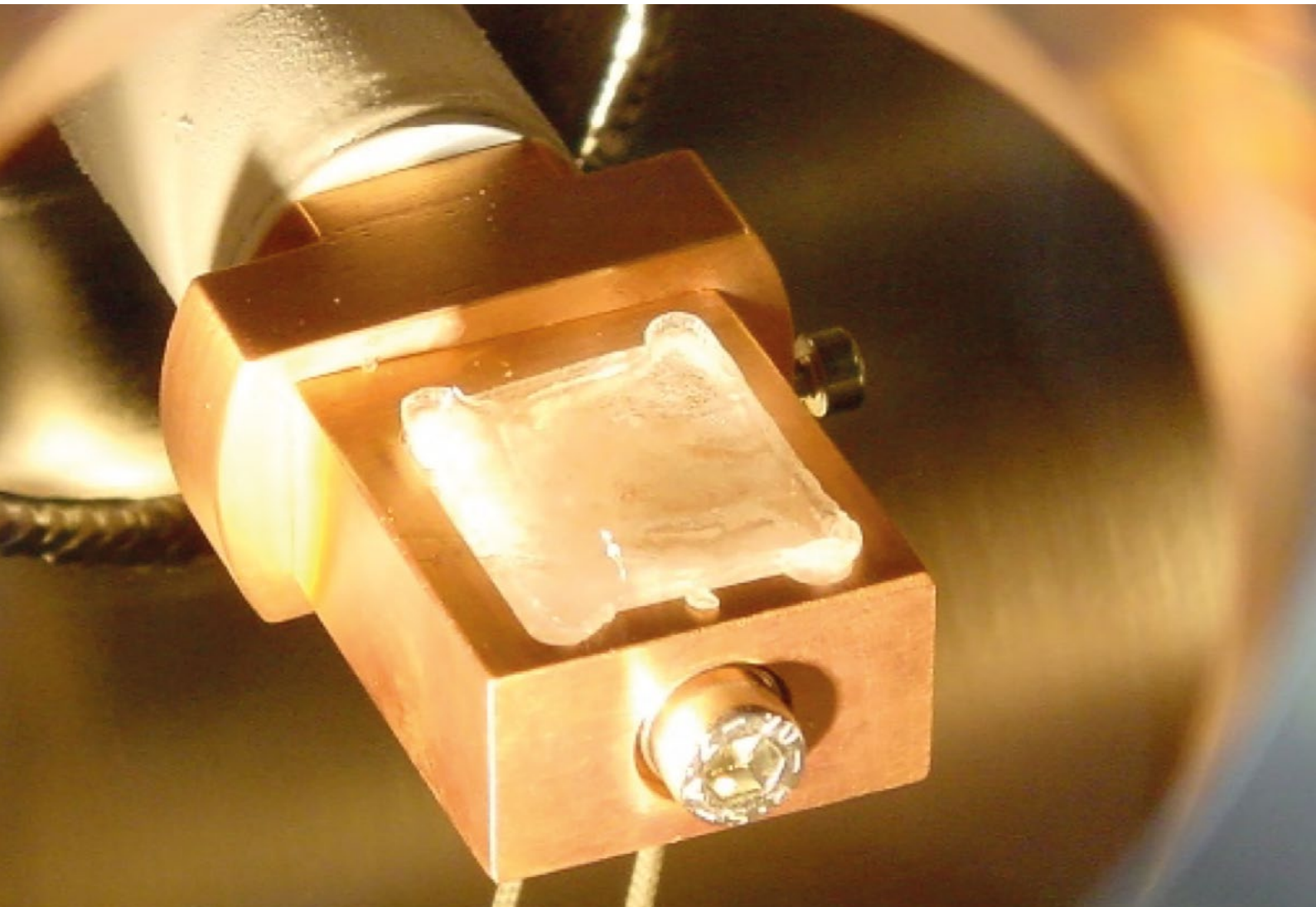
PECVD equipment is designed for materials such as SiO2 at high deposition rate, starting from a liquid precursor injected in the chamber in vapour phase.
Our System can be equipped with a **Inductively or Capacitive Coupled** RF-sources according to customer requirements.
In case of Capacitive coupled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

Athomic 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.



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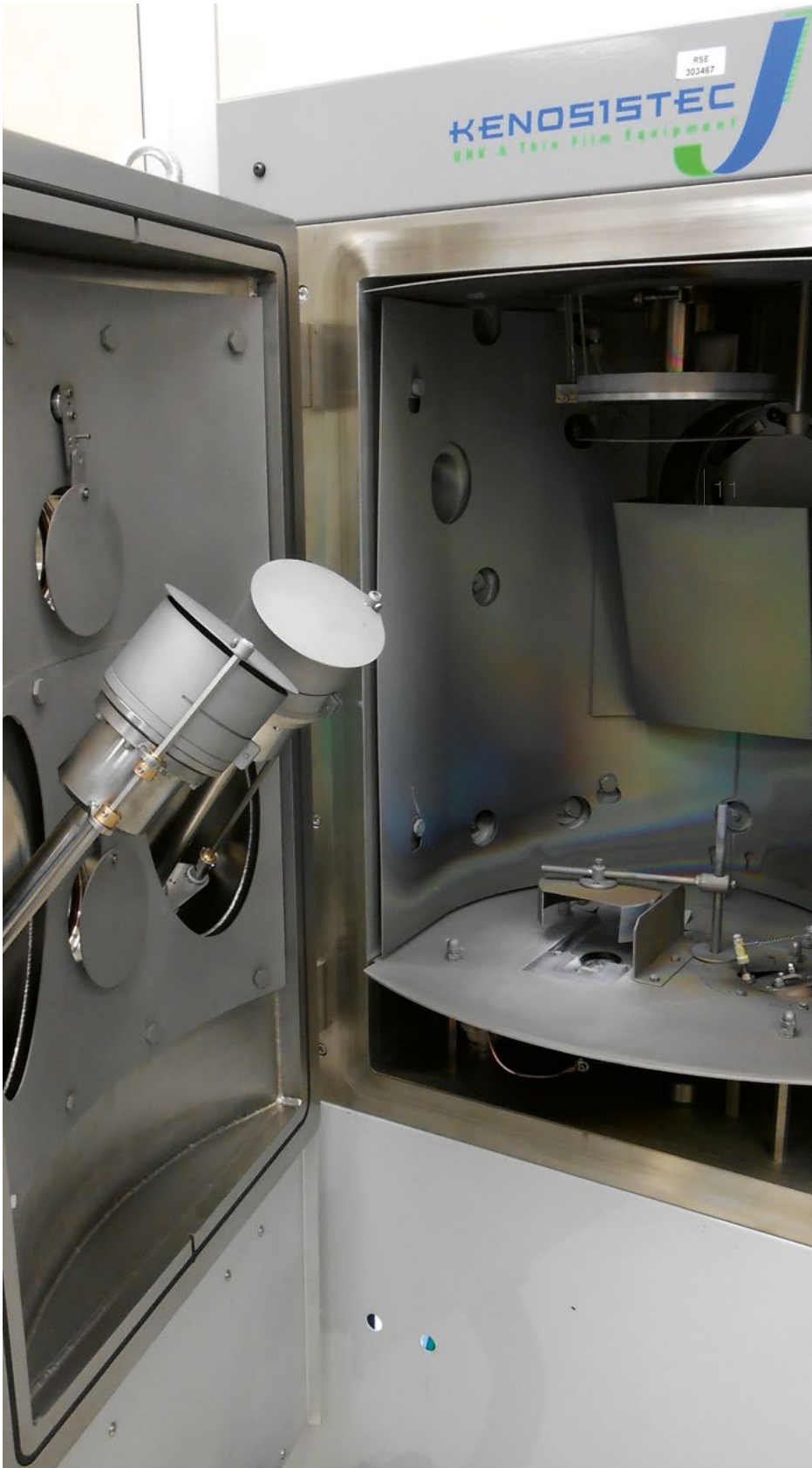
Combined Technologies Systems

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:

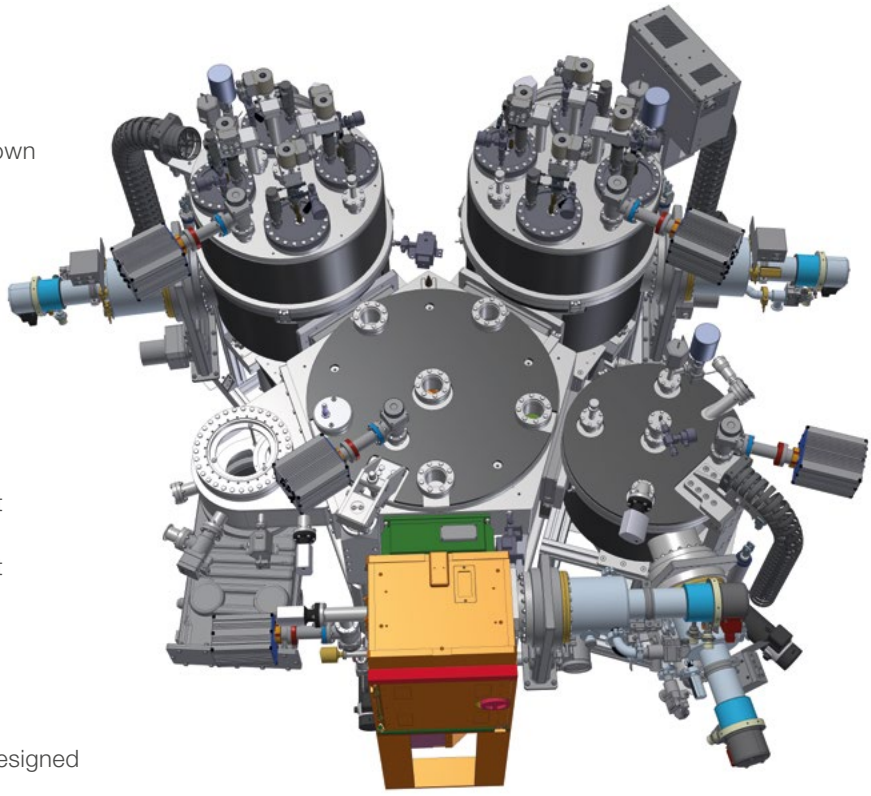
- **HiPIMS, DUAL magnetron sputtering with Cathodic Arc Evaporation Sources;** especially designed to offer the best results for tribology coatings.
- **Sputtering, Thermal and E-beam evaporation;** great results for optics and microelectronic field.
- **Sputtering and PECVD;** fine properties of PVD 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.



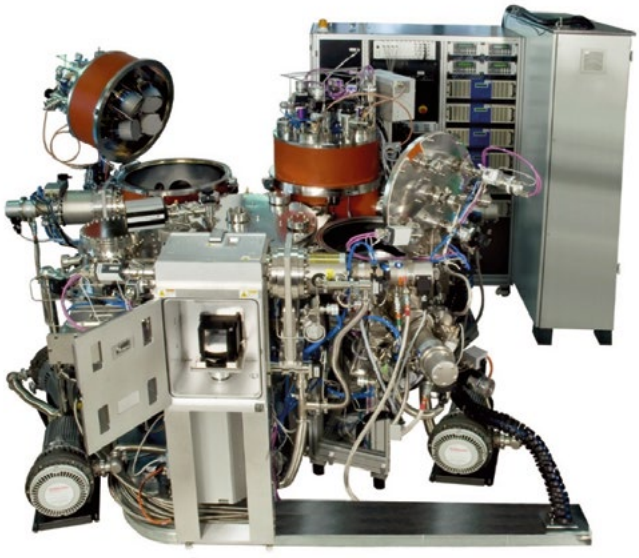
Cluster

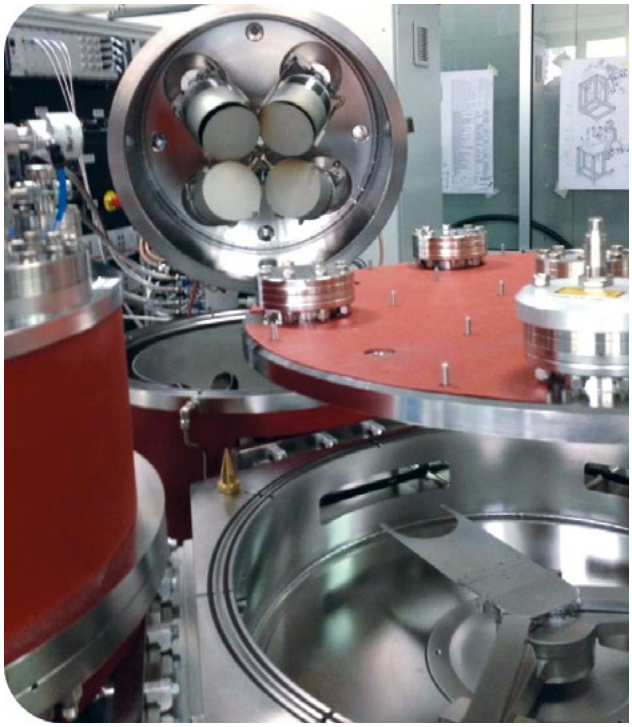
Cluster is a Multi-chamber system where samples run from a chamber to another.
Each chamber can be equipped with its own technology (such as sputtering and/or evaporation and/or plasma cleaning).
A possible configuration is represented by KS 800 Cluster:

- 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



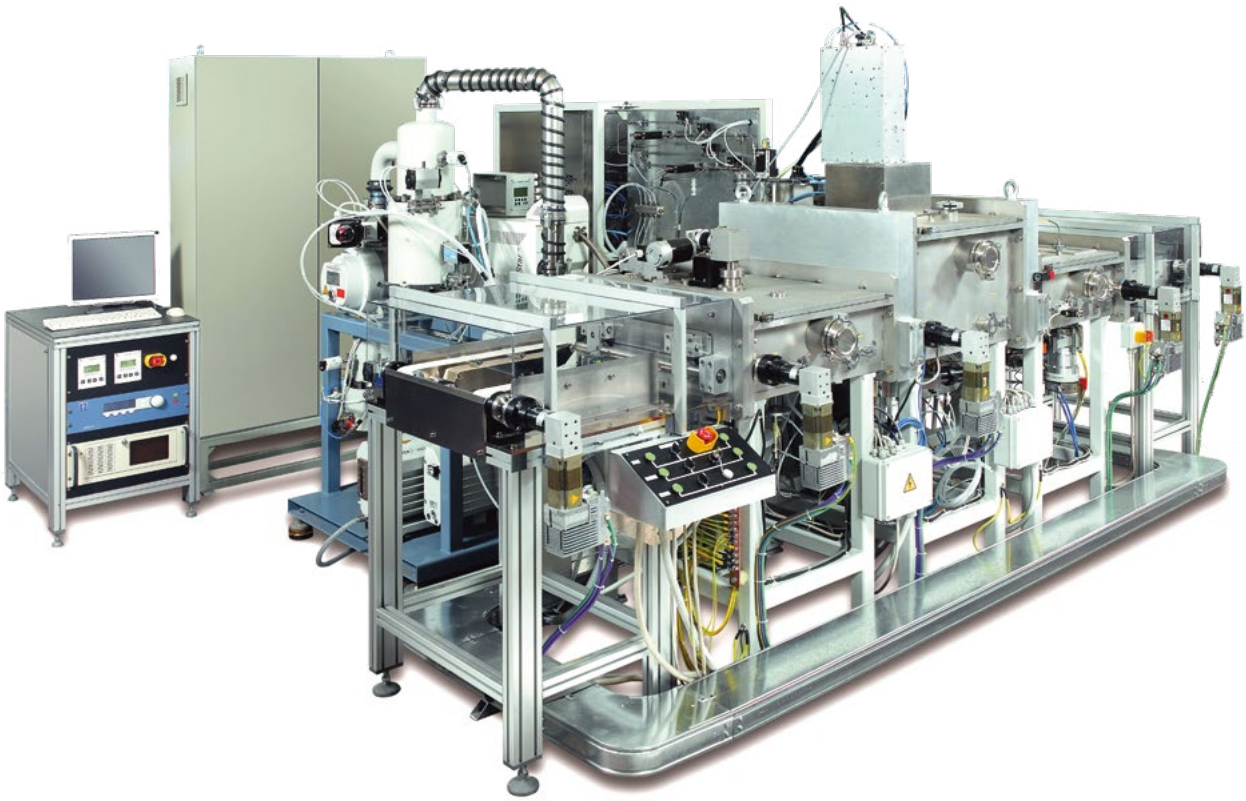
The advantage of such design is to keep each process separated in order to avoid cross contamination.
As a further plus, each chamber can be designed to meet process specific requirements.
A cassette-to-cassette load lock is connected to a transfer-park module from which the samples can be moved to the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



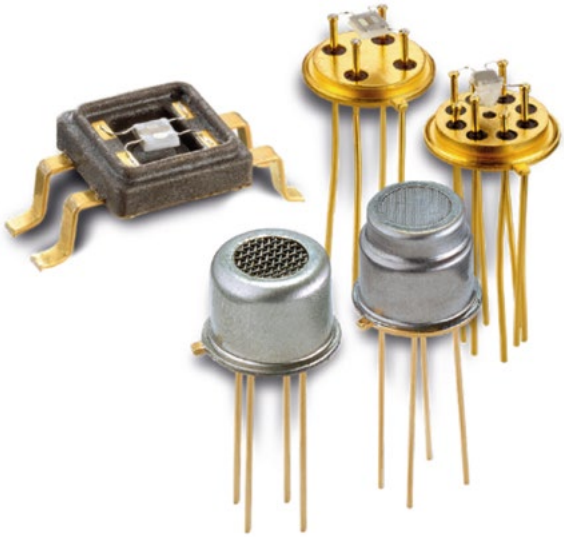
Gas Sensor Test System

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

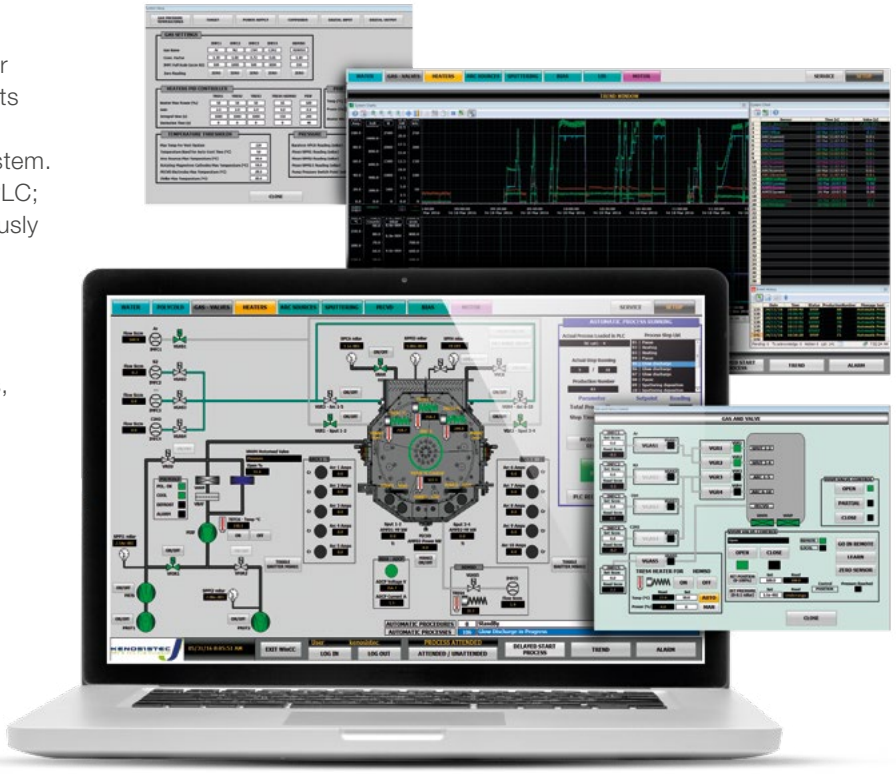
The system allows an extremely **high accuracy and repeatability**. A volumetric mixture is prepared by mass-flow-controllers (MFCs with an appropriate range) starting from pure gases.
The system can include a dry-air line, a wet-air line and dry-gases lines. Those lines are made of stainless steel with 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 it 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

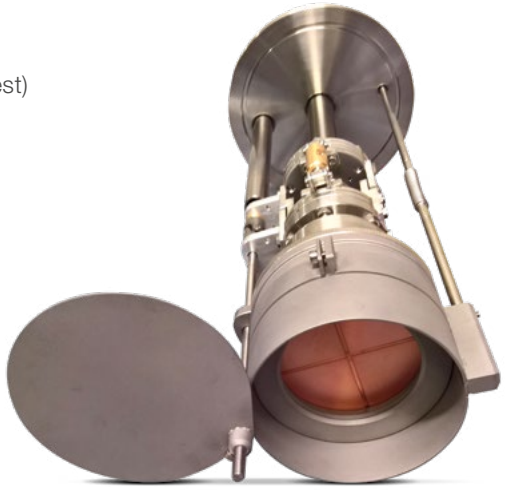
Magnetron Sources

- 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

MAIN FEATURES	2° target	3° target	4° target
Max Power (direct cooling)			
DC, DC pulsed, HiPIMS:	400 W	800 W	1600 W
RF:	200 W	400 W	750 W
Max Power (indirect cooling)			
DC, DC pulsed, HiPIMS:	250 W	500 W	1000 W
RF:	100 W	200 W	400 W



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

MAIN FEATURES	Max Density
Direct cooling	
DC, DC pulsed, HiPIMS:	15 W/cm^2
RF:	10 W/cm^2
Indirect cooling	
DC, DC pulsed, HiPIMS:	8 W/cm^2
RF:	4 W/cm^2

CAE Cathodic Arc Evaporation Sources

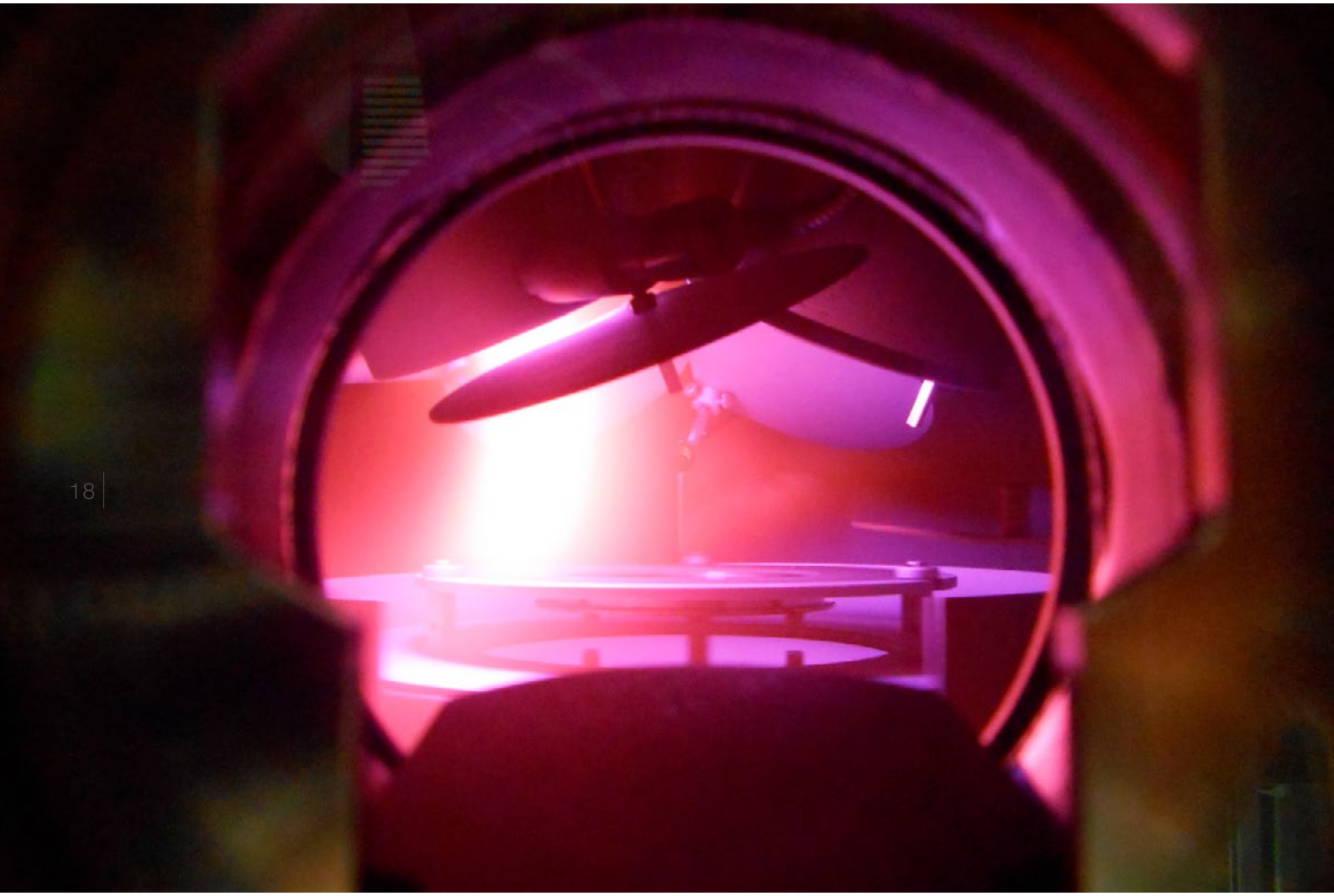
- Cathode diameter: 63 or 100 mm
- Up to 250 A
- Arcs ignition trigger (own design)
- Fast Protection in case of trigger short circuit (i.e. trigger melted to the target)
- Special dark space shield for droplets reduction
- Target easy mounting;
  Cost effective targets manufacturing
- Effective erosion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

MAIN FEATURES	Properties
DC (air cooled)	500 W (1000V - 1A)
RF (air cooled) and Matching Network (automatic)	200 W 300 W 400 W 750 W
Arc Generator (for CAE sources air cooled)	150 A 250 A

Vacuum Components



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

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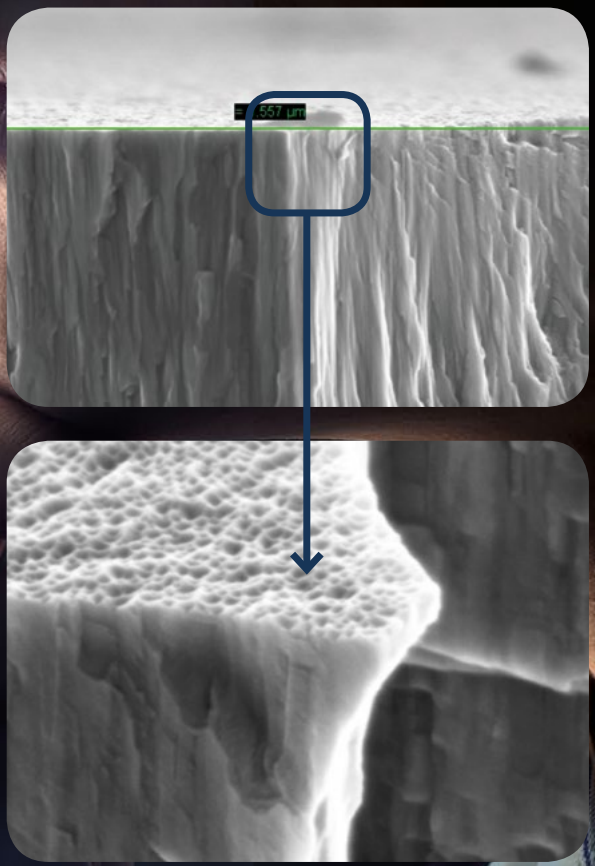
Services

Process development

Kenosistec is able to translate customer needs, in term 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.

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Angelantoni Group. Innovation to excel.

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

COATING TECHNOLOGIES

Kenosistec started in 1968 producing vacuum coating equipment for R&D purposes. Since then it has grown in terms of expertise and automation technology so to meet high level requirements of reliability and volume capacitiy, necessary for the Industrial production field.

Kenosistec can offer a wide range of technologies: PECVD, PVD, Metallization, PLD, ALD, Evaporation and Etching.
Customer needs are fulfilled by supplying customized equipment.

V-See Software is versatile and flexible and it allows a fine tuning of the coating process. It provides a wide range of reports and logs, fulfilling many production requests.

ENVIRONMENTAL TESTING

Since its launch on the market in 1952, the ACS brand has had a mission: to be at the forefront of environmental testing technology.

Flower®: the ecological environmental test chamber, with energy savings of up to 70% without affecting performance.

MyKratos™ Control System: ACS was the first to launch on the market environmental test chambers capable of meeting the new demands of the Industrial Internet of Things and Industry 4.0 for integrated, interconnected, and communicating machines.

- calorimeters for testing the energy efficiency of air conditioners in the household appliance and automobile sectors;
- high-vacuum chambers for tests on satellites and satellite parts;
- HALT/HASS test chambers for the accelerated stress test to verify component reliability.

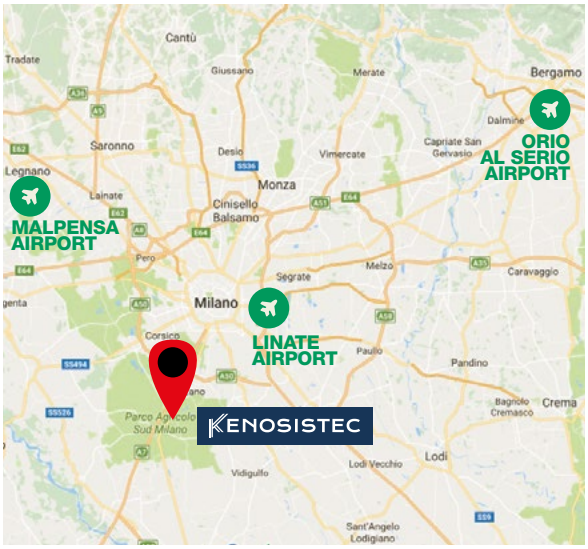
BIOMEDICAL FIELD

Angelantoni Life Science (ALS) research has led to the development of unique, high-tech biomedical equipment such as:

- Hemosafe®, a computerized and patented refrigerated blood bank for storing and distributing bags of packed red blood cells
- Smartfreezer®, the first robotized biorepository in the world for biological materials (stem cells, etc…) with storage in liquid nitrogen vapour at -180°C
- Waster®, to transform contaminated and hazardous hospital waste into standard waste.

CLEAN TECHNOLOGIES

Angelantoni CleanTech (ACT)'s most important achievement is the development of a patented, technologically advanced system, called TURBOALGOR®, whose aim is to improve the efficiency of old and new commercial and industrial refrigeration systems for frozen food, ice-cream and pharma. TURBOALGOR® consists of an energy recovery heat exchanger and a turbocharger, derived from the automotive industry, installed into a conventional refrigeration plant. TURBOALGOR® produces energy savings up to 23% in comparison with existing systems and cooling power increase up to more than 50%, depending on the operating conditions of the plant.



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.

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001

Kenosistec Srl
Viale delle Scienze, 23
20082 Binasco (MI) - Italy
Tel. +39 02.90.55.200
Fax. +39 02.90.52.984
info@kenosistec.it

30 km away from Airport of Linate
65 km away from Airport of Malpensa
78 km away from Airport of Orio al Serio

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Kenosistec in the world

Angelantoni Test Technologies India pvt. ltd.
Office No. 3, Second Floor
Tower-1 Stellar IT Park, C-25, Sector-62 - 201309 Noida
Tel +91 120 4230042-44 - info@attindia.in - **www.attindia.in**

Att Asia Pacific
Room 1708, Zhubang2000 (Business Bldg 4), Balizhuang Xili
no. 97, Chaoyang District - 100029 - Beijing
Tel +86 10.65584982 - Fax +86 10.65584982
info@attasiapacific.com - **www.attasiapacific.com**

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Kenosistec Srl
Viale delle Scienze, 23 - 20082 Binasco (MI) - Italy
Tel. +39 02.90.55.200 - Fax. +39 02.90.52.984
info@kenosistec.it

www.kenosistec.com
www.angelantoni.com