Solutions for Research, Development & Production
ADVANCED MATERIALS

Leading supplier of advanced materials for research, industrial, and laboratory applications. These include:

- Metal Single Crystals & Bicrystals
- Highest Purity Materials
- Oxide Single Crystals
- Evaporation Materials
- Thin Film Materials
  - Sputtering Targets
  - Backing Plates
  - Bonding
- Optical Materials
  - Fluorides (BaF2, CaF2, LiF, MgF2)
  - Chlorides (AgCl, NaCl, KCl, KBr)
  - Infrared (ZnSe, ZnS, Ge, Si)
  - Monocrystalline: Sapphire, Quartz
  - Undoped Garnets: YAG, GGG
- III-V Materials
- Re-polishing & orienting of customer’s samples

NLO/LASER CRYSTALS

- KTO
- KTA
- KDP
- BBO
- LiNbO3
- LiTaO3
- Cr:YAG
- MgO:LiNbO3
- YAG Crystals: Er:YAG, Nd:YAG, Yb:YAG, Cr, Tm, Ho:YAG
- YLF Crystals: Ho:YLF, Nd:YLF, Tm:YLF, Er:YLF
- YSGG Crystals: Er:YSGG, Er, Cr:YSGG, Cr, Nd:YSGG
- YAP Crystals: Er:YAP, Nd:YAP, Tm:YAP
- Other: Alexandrite, Ti:Sapphire, Forsterite, Nd:YVO4, Diffusion bonded crystals

PLASMA TECHNOLOGY

We offer a wide range of products from low-cost laboratory plasma cleaners to custom plasma treatment systems for academia and industry.

- Plasma cleaning treatments
- Plasma surface activation treatments for improved adhesion
- Plasma coatings – hydrophilic and hydrophobic treatments
- Low pressure benchtop plasma systems
- Large capacity advanced plasma systems
- Microscopy plasma systems
- Atmospheric plasma treatment
- Surface testing equipment

PRECISION WIRE SAWs

- Can cut semiconductors, ferrites, metals, glasses and other hard or brittle solids. Cut samples using two different methods (wet and dry cut)
- Cut surfaces of nearly “lapped” quality
- Minimal loss of material
- Cutting that does not introduce deformations
- Wire diameters from 20µm to 60µm
- No “wandering” of cutting wire in an unintended direction
- Cut under any desired angle feasible
- Cut samples up to a size of 80x80x150mm
- Semi-automatic, requires no supervision

UHV TECHNOLOGY

A wide selection of vacuum products & equipment for the research community and high tech industry which include:

- Analytical UHV Systems
- UHV Deposition Systems
- Transport Chambers
- Load Lock Chambers
- Ion Sources
- Manipulators
- Power Supplies, Control Units, and Software
Founded in 1991, Princeton Scientific Corp. is a worldwide supplier of material science & engineering related products plus particle beam line technology, wire saws & UHV technology for scientists, engineers, and industrial manufacturers.

We have an excellent and long-standing reputation for Metallic Single Crystals, Sputtering Targets, Superconductor substrates, Laser Crystals, Optical Materials, Opto-Electronic Components, and various Oxide Crystalline Materials within the scientific community.

Not only do we offer crystal boules, blanks, semi-finished- and finished products in the form of wafers, windows, lenses, prisms, tubes, rods, crucibles but also cutting and polishing services for such materials. In addition to materials, we also offer Precision Wire Saws, Particle Beam Line & Diagnostics and UHV Technology.

We were recently able to expand our program for HV & UHV Technology applications in the materials sector.

Princeton Scientific Corp. now offers:

▶ Analytical and Deposition UHV Systems
▶ Ion / UV / X-Ray Sources
▶ Hemispherical Energy Analyzers
▶ Manipulators and Transferring Systems
▶ UHV Chambers
▶ Power Supplies & Control Units
▶ Advanced Software Solutions

All of these devices are designed and built to the highest quality standards.
Sputtering Targets

Princeton Scientific Corp. offers Sputtering targets made of metals, non-metals and chemical compounds with purities ranging from 99.9% to 99.9999%.

We offer standard, single element, pure metals and custom compounds. We also have various geometric shapes; round, rectangular, as well as multi-tile and stepped constructions are possible.

Please review our standard and specialty target list for more information. Princeton Scientific can produce sputtering targets to your specific needs. We will help to select appropriate target material, fabrication process, and bonding assembly that ensures the success of your thin film deposition process. Our Sputter targets are prepared either by a melt- or a powder metallurgical process.

We also provide an assorted array of backing plates for your systems requirements. Also, our bonding services include various metallic or silver epoxy techniques.

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| SULFIDES, SELENIDES, TELLURIDES |

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Princeton Scientific Corp. provides a wide variety of evaporation materials for the vacuum deposition industry. Our materials are available in various purities ranging from 99.9% to 99.9999%. Evaporation material can be made to order in the following forms:

- Chunk
- Foil
- Pellet pieces
- Wire
- Rod
- Shot
- Slug
- Starter
- Source
- Tablet
- Granules

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<tr>
<th>METALS</th>
<th>RARE EARTH</th>
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<th>OXIDES</th>
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<td>Barium</td>
<td>Erbium</td>
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<td>Earth Alloys</td>
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Evaporation Materials
Princeton Scientific Corp. provides a wide variety of evaporation materials for the vacuum deposition industry. Our materials are available in various purities ranging from 99.9% to 99.9999%. Evaporation material can be made to order in the following forms:
Metal Crystals

Application: Metal single crystals are required, among others, for basic research (surface physics, catalytic chemistry, investigation of material properties, etc.), for monochromators (for X-ray, neutrons, etc.) and electrons (W-needles, LaB6, CeB6, etc.). Properties: The quality of our crystals is characterized by an especially high mosaicity. During application of the surface, particular emphasis will be put on orientation accuracy of the crystallographic direction (orientation accuracy). The especially careful surface conditioning (polishing) allows, after low heat and sputter cycles, the direct investigation of up to several 1000 nm spread nuclear terraces. Mosaicity of the elements: the mosaicity describes the deviation of the perfect structure of the crystal. It is the angle specification which describes the deviation of a reflective X-ray jet and the ideal reflex angle. A small angle stands for a perfect crystal structure. Orientation accuracy: up to <0.05° Polishing: roughness < 1nm (also at soft elements as Au or Pb) Geometric: Several geometries are available. See our website for all geometries we offer. When requesting a quote please specify geometric shape. In case the desired geometries are not available on our website, please send us a drawing for a quote. Production of metallic single crystals is carried out in most modern equipment with highest quality requirements. For crystal growth using the Bridgman-, Czochralski- and zone melting techniques only highest purity starting materials are used.

Additional Services

- High Quality Crystal Processing of customer provided materials
- Re-polishing of customer provided materials (both or single side)
  - Roughness <10nm (typically 1nm for hard metals and typically <1-5nm for soft metals, even for Pb)
  - orientation accuracy <2 deg
  - orientation accuracy <1 deg
  - orientation accuracy <0.4°
  - orientation accuracy <0.1° (possible up to <0.05°)
- Cutting and/or orienting customer provided crystals
- Laue pictures
- Measuring of roughness
- Diverse cuttings and cut of geometrics according to your specifications
- Diverse drillings
- Etching of the surface according to your specifications
- Install of a wire for direct electronic contact of the sample
- Install of chamfers
- Bonding & de-bonding of sputtering targets
- Complete coating services
Laser Crystals

We offer common host crystals such as YAG (Yttrium aluminium garnet) or YVO4 (Yttrium orthovanadate) with various dopants such as Neodymium, Ytterbium, Erbium and Chromium. The ready to use (coated) or uncoated laser rods are manufactured to the highest standards of our crystal technology. All of LASER COMPONENTS’ AR coatings are optimized for high power lasers and are available for the wavelength range from 193 nm to 3000 nm. Both the bandwidth (depending on the wavelength) and the effectiveness of the coating can be influenced by the various designs and different coating materials. Thus the optimal coating for each application can be made available. Custom sizes, polished, unpolished, coated and uncoated crystals are available upon request. Please provide us with your detailed specs or drawing so we can provide our most competitive offer.

<table>
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<th>NLO CRYSTALS</th>
<th>LASER CRYSTALS</th>
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<td>Yb:YAG</td>
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<td>NaI (Tl)</td>
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Plasma technology has been an important production tool for many decades, one example is in the fabrication of microelectronic device. Over this period, plasma technology has also become invaluable in many other areas of industry including automotive, medical devices, textiles, and aerospace to name a few.

We offer a wide range of products from low-cost laboratory plasma cleaners to custom plasma treatment systems for academia and industry, including:

- Plasma cleaning treatments
- Plasma surface activation treatments for improved adhesion
- Plasma coatings – hydrophilic and hydrophobic treatments
- Low pressure benchtop plasma systems
- Large capacity advanced plasma systems
- Microscopy plasma systems
- Atmospheric plasma treatment
- Surface testing equipment

What is plasma treatment & what can plasma treatment do?

Plasma treatment is used to clean and activate surfaces to improve their adhesion characteristics. Plasma cleaning removes trace organic contamination from the surface, which would otherwise prevent good adhesion. At the same time, plasma treatment activates the surface and turns it from a low to a high surface energy state so that it becomes easily wettable by adhesives, paint, glue etc. Plasma treatment solves problems of poor adhesion in many industries.
Microscopy Plasma Cleaners

Our plasma cleaners for microscopy applications are low-cost benchtop systems designed specifically for fast and efficient cleaning of TEM sample holders as well as SEM stubs. The TEM plasma cleaner is fully automated and comes with standard adapters which are suitable for the sample holders supplied from all the major microscope manufacturers. The plasma output power is fully variable over the range 0-100W, resulting in a very controllable & gentle cleaning process.

The TEM plasma cleaner is an application specific solution for low-pressure plasma cleaning and preparation of electron microscopy samples, including:

- Low power operation
- Front feed of TEM sample holder
- Multiple TEM grids and SEM stub cleaning
- Re-entrant style sample holder introduction
- Dual gas inlets for O2/Ar and other gases

MICROSCOPY PLASMA CLEANERS

HPT-100 TEM Plasma Cleaner: 100mm diameter cylindrical chamber (2 litre volume) with TEM holder adapters and removable parts tray.

HPT - Low Pressure Plasma Treatment

Our ‘HPT’ range of low-pressure plasma treatment systems are microprocessor-controlled benchtop devices that are ideal for routine laboratory, R&D, and light industrial tasks. Due to their ease of use and reliability, they are the instrument of choice for many of the world's leading companies and institutes, where they are used to clean surfaces and activate materials in order to increase wettability and improve adhesion. Our HPT plasma systems are perfect for surface cleaning, surface preparation, and surface modification of a wide range of materials including metals, glass, polymers, ceramics, plastics, and composites. Key applications include composites joining development, microfluidics PDMS bonding, microscope sample cleaning, optics cleaning, metals cleaning, biomedical applications, polymer science, and medical device manufacture.

HPT LOW PRESSURE PLASMA SYSTEMS

HPT-100: 100mm diameter cylindrical chamber (2 litre volume)
HPT-200: 150mm diameter cylindrical chamber (5 litre volume)
HPT-300: 200mm x 200mm rectangular chamber (12.5 litre volume), multiple parts trays
HPT-500: 240mm x 240mm rectangular chamber (23 litre volume), multiple parts trays
Atmospheric Plasma Treatment

The Cirrus atmospheric plasma device localized improvement of the adhesion characteristics of a wide range of materials.

It is a compact standalone instrument which delivers a continuous plume (8-10mm wide) of low temperature plasma to the surface and can easily be integrated with assembly/production lines with or without robot handling. The Cirrus operates with compressed air and doesn’t require any special gases or other services. A rear panel sub-D connector allows start/stop triggering of the plasma via an external signal supplied by the line.

The Nimbus atmospheric plasma device is the dual nozzle version of the Cirrus atmospheric plasma device. Plasma zones can be applied to different areas or overlapped to cover wider areas.

Atmospheric plasma advantages:

- Fast localized atmospheric plasma pre-treatment of parts prior to bonding
- Ultrafine atmospheric plasma cleaning
- Surface activation with atmospheric plasma
- Highest quality treatments
- Very low operation cost & easy integration with automated lines

Atmospheric plasma cleaning & activation of:

- Polymers
- Metal
- Ceramics
- Glass
- Composites

ATMOSPHERIC PLASMA TREATMENT:

Atmospheric Plasma System: Cirrus and Nimbus, single and dual nozzle versions
Nebula - Low Pressure Plasma Treatment

Our ‘NEBULA’ range of low-pressure plasma treatment systems are standalone systems with large capacity chambers for treating larger format parts, or more parts in a single batch.

They are suited to both regular industrial usage and also for development of new processes and surface chemistry. NEBULA plasma treatment systems have a large HMI interface and are controlled via an industrial PLC system. They allow user level access ranging from simple operator, able to execute programs only, to full administrator, able to create users, edit, and test new recipes. Due to their flexibility and robustness, they are chosen where reliability and flexibility are paramount.

Each NEBULA system can be configured with a variety of options including horizontal and vertical sample loading and also a rotary drum for treating many small parts or even powders. The user can specify up to three gas inlets as well as a precise monomer dosing inlet for plasma polymerization work. In this way, simple cleaning and activation tasks can be extended to produce permanent polymeric coatings on many surfaces.

Our NEBULA range of low-pressure plasma treatment systems are perfect for cleaning, activation, and deposition onto a wide range of materials. Key applications include surface preparation to improve bond adhesion and plasma polymerization to produce hydrophilic or hydrophobic coatings.

**NEBULA LOW PRESSURE PLASMA SYSTEMS:**
- NEBULA-30: 30 litre plasma processing chamber (300x300mm x 375mm D)
- NEBULA-50: 50 litre plasma processing chamber (300x300mm x 600mm D)
- NEBULA-100: 100 litre plasma processing chamber (400x400mm x 600mm D)
- NEBULA-150: 150 litre plasma processing chamber (400x600mm x 600mm D)
Precision Wire Saws

Precision wire saws available from Princeton Scientific have been developed with an improved cutting technique that utilizes the precision guidance of the width and uniform application of an abrasive slurry. This results in:

- Surface is almost ‘lapped’ quality
- Cutting that does not introduce deformations (eliminate the part “or defects”)
- Minimal loss of material
- Wire diameters from 20µm to 60µm
- No “wandering” of cutting wire into an unintended direction
- Cut samples up to size 80mm x 80mm x 150mm
- Semi-automatic, requires no supervision

These precision wire saws are ideal for the precise cutting of:
- Semiconductors
- Ferrites
- Metals
- Glasses
- Other Hard or Brittle Solids

A variety of precision wire saws are available that can cut samples down to a thickness of 10µm, with smooth cut surfaces where the roughness does not exceed 1µm. With a goniometer mounted to the saw, very precise orientations of crystal surfaces are possible before the cutting process begins.

NEW

One Saw, Two Cutting Methods (dry and wet)

The WS-25 wire saw is the first wire saw that can cut with free abrasive method as well as with diamond dotted wire. The WS-25 wire saw is fitted with an adjustable sample support with electronic vertical axis. The sample is automatically moved up during the cutting process. The wire frame stays at the same vertical position throughout the entire process.

The WS-25 wire saw has been developed to meet two important requirements: 1) cutting should not introduce deformations or defects, and 2) loss of material should be minimized. These two requirements have been met by the development of an improved cutting technique which utilizes the precision guidance of the wire and uniform application of an abrasive slurry. The WS-25 wire saw is a semi-automatic machine and requires no supervision during its operation. The wire saw can be used for precision cutting of semiconductors, ferrites, metals, and glasses, as well as many other hard or brittle solids. The WS-25 wire saw enables cutting of very thin slices (down to a thickness of 10µm) with smooth cut surfaces (where surface roughness does not exceed 1µm).

VISIT OUR WEBSITE FOR OUR OTHER WIRE SAW MODELS
www.PrincetonScientific.com
**HIGH VACUUM & ULTRA HIGH VACUUM SYSTEMS**

We design and manufacture a wide range of bespoke HV and UHV systems configured with any combination of techniques such as:

- XPS / ESCA
- HP XPS
- UPS
- ARPES
- ARUPS
- ISS
- HREELS
- FTIR
- IRAS
- MOKE
- MBE
- PLD
- RHEED
- CVD
- PECVD
- HIPIMS
- Sputter deposition
- Thermal evaporation
- AFM
- STM
- LEED / AES
- TPD
- RIXS
- others

**MANIPULATORS, GONIOMETERS & FEEDTHROUGHS**

- XY stages
- Z manipulators
- XYZ manipulators
- Multi axes manipulators (up to 6 axes)
- Manipulators with rotations
- LN2 or LHe cooled manipulators
- Motorization for all modules
- Linear feedthroughs
- Rotary feedthroughs
- Differentially pumped rotary feedthroughs
- Linear shifts
- Wobble sticks
- Goniometers

**CHAMBERS AND MECHANISMS**

- Analytical chambers
- Preparation chambers
- Load lock chambers
- Sample park chambers
- Radial distribution chambers
- High pressure reactors
- Cleaver chambers
- Reorientation chambers
- Linear transfers
- Transport boxes
UHV Technology

SAMPLE HOLDERS

- Sample heating by resistive heating method (up to 1000°C), direct heating or electron beam heating (up to 2000°C)
- Various types of the PTS sample holders - up to 8”
- Helium and nitrogen cooling
- Versions for reactive gas atmospheres

- Holders dedicated for: quartz balance, Faraday cup, high pressure reactors, powder materials
- Adapters for flag style sample holders
- Detachable contact for heating & cooling
- IR & UV transmission mode
- Integrated charge compensation

Approximately 200 individual designs of sample holders have been manufactured to date.

INSTRUMENTS

- Hemispherical energy analyzer
- X-ray source
- X-ray monochromator
- UV source
- Ion source with wien filter option
- Electron source
- Flood source
- Electron beam evaporator
- Effusion cell
- Cylindrical mirror analyzer
- Quartz balance
- Thermal desorption spectrometer

ACCESSORIES

- Titanium sublimation pumps and liquid nitrogen shields
- Vacuum KF-fittings
- Ultra high vacuum CF-fittings
- Electrical feedthroughs
- Fluid feedthroughs
- Bakeout equipment
- Components for load locks
- Vacuum doors
- Shutters
- Mass flow control systems
- Water cooling devices

Approximately 200 individual designs of sample holders have been manufactured to date.
**ELECTRONICS**

- Vacuum control devices
- Thickness monitor controllers
- Stepping motor control drivers
- Ion source power supplies
- Sample heating power supplies
- Wide range vacuum gauge controllers
- Thickness/rate controllers
- Electron source power supplies
- Electron beam evaporator power supplies
- Titanium sublimation pump power supplies
- High voltage electronics
- Bakeout control devices
- Emission regulators

**SOFTWARE**

- Manipulator control application
- Thermal desorption spectroscopy control application
- Pressure control application
- PID control application (thermal process control)
- Automatization of the samples transfer system
- Vacuum process control system
- Able to connect/communicate with most of our devices
- Dedicated software for customers’ systems and devices
- Integration with TANGO and other control systems

**SERVICES**

- Warranty & after warranty service
- Maintenance & repair services of Manipulators and vacuum transfers
- Maintenance & repair services of HV and UHV systems
- UHV compatible machining and welding
- Electronic units maintenance & repair services
- X-ray anodes recovery
- Components maintenance & repair services
Solutions for Research, Development & Production