Solutions for Research, Development & Production
UHV TECHNOLOGY

Metal Single Crystals & Bicrystals
Highest Purity Materials
Oxide Single Crystals
Evaporation Materials
Thin Film Materials
- Sputtering Targets
- Backing Plates
- Bonding

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

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

PRECISION WIRE SAWS

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

NLO/LASER CRYSTALS

- KTO
- KTA
- KDP
- BB0
- 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
About Princeton Scientific Corporation

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.
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.

<table>
<thead>
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<th>BORIDES</th>
<th>CARBIDES</th>
<th>FLUORIDES</th>
<th>NITRIDES</th>
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<td>KF</td>
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<td>ThF4</td>
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<td>VSi2</td>
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<td>and others</td>
<td>ZrC</td>
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</tr>
<tr>
<td>CdTe</td>
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<tr>
<td>PbSe</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:

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

### METALS

<table>
<thead>
<tr>
<th>Material</th>
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<td>Selenium</td>
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<td>Iridium</td>
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<td>Carbon</td>
<td>Iron</td>
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<td>Holmium</td>
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<td>Neodymium</td>
<td>Praseodymium</td>
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<td>Terbium</td>
<td>Thulium</td>
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### ALLOYS

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<tr>
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<td>Au/Pt</td>
<td>Co/Ta/Zr</td>
<td>Ge/Te</td>
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<td>Cu/Cr</td>
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### OXIDES

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<td>PbZrO3</td>
<td>Supercond.</td>
<td>Y2O3</td>
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<td>Sb2O3</td>
<td>HfO2 unstab.</td>
<td>LiNbO3</td>
<td>Sr0</td>
<td>ZnO</td>
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<tr>
<td>BaTiO3</td>
<td>HfO2/CaO</td>
<td>MgO</td>
<td>SrTiO3</td>
<td>ZnO dop.</td>
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<tr>
<td>Bi2O3</td>
<td>HfO2/Y2O3</td>
<td>MoO3</td>
<td>SrZrO3</td>
<td>ZrO2 unstab.</td>
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<td>In2O3</td>
<td>Nb2O3</td>
<td>Ta2O5</td>
<td>ZrO2/CaO</td>
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<td>ITO</td>
<td>Nb2O5</td>
<td>Th2O</td>
<td>ZrO2/Y2O3</td>
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<td>Re2O3</td>
<td>SnO2</td>
<td>and others</td>
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<td>CaO2</td>
<td>La2O3</td>
<td>SiO2</td>
<td>TiO2</td>
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<td>Cr2O</td>
<td>PbTiO3</td>
<td>SiO</td>
<td>WO3</td>
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</table>
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 geometrics 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
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.

### NLO CRYSTALS

<table>
<thead>
<tr>
<th>LBO</th>
<th>KTA</th>
<th>Bi8306</th>
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<tbody>
<tr>
<td>BBO</td>
<td>LiNbO3</td>
<td>MgO:LiNbO3</td>
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<tr>
<td>KTP</td>
<td>KD2P &amp; KDP</td>
<td>Li1O3</td>
</tr>
</tbody>
</table>

### LASER CRYSTALS

| Nd:YVO4 | Nd:YLF |
| Nd:GdVO4 | Ho:YLF |
| Nd:YAG | Nd:KGW |
| Cr4+:YAG | Yb:KGW |
| Ho:Cr:Tm:YAG | Er:YAP |
| Nd:Ce:YAG | Nd:YAP |
| Yb:YAG | Forsterite |
| Er:YAG | Alexandrite |
| Ce:YAG | Er:Cr:YSGG |
| Ti:Sapphire | Diffusion Bonded Crystals |
| Nd:GGG | |

### ACousto-optic CRYSTALS AND ELECTRO-OPTIC CRYSTALS

| LiTa03 | LiNb03 |

### Birefringent CRYSTALS

| YVO4 | LiNbO3 |
| a-BBO | |

### Scintillation CRYSTALS

| CsI | YAG (Ce) |
| LaBr3(Ce) | Nal (Tl) |
| | LaCl3(Ce) |

### Magnetooptical CRYSTALS

| TGG | TSAG |
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 20 µm to 60 µm
- 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.

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
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

Motorization for all modules
- Linear feedthroughs
- Rotary feedthroughs
- Differentially pumped rotary feedthroughs
- Linear shifts
- Wobble sticks
- Goniometers

- XY stages
- Z manipulators
- XYZ manipulators
- Multi axes manipulators (up to 6 axes)
- Manipulators with rotations
- LN2 or LHe cooled manipulators

- 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
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