



OPTICAL COATING

FROM
CONCEPT TO
COMMERCIALIZATION

PRODUCT CATALOG



PI-KEM

UK & European
Distributor





ABOUT US

Since 1989, LTS Research Laboratories Inc., has been a leader in the manufacture and supply of purity chemicals to the optical, electronics, and semiconductor industries. We started in 1992 with the discovery of the Direct Fluorination Method (DFM), used originally to purify Scandium oxide. The DFM process was applied to a variety of fluoride materials which found immediate success in UV-IR applications. In 1992, the DFM process was also applied to synthesize YBC, our Thorium fluoride replacement flagship materials for MIL-grade optics in DUV and IR-FIR spectra CO₂ laser applications. Today, our YBC materials are pivotal in guidance systems and are utilized by militaries around the globe.

In 1998, LTS commercialized extremely low Zirconia-containing Hafnium oxide products for excimer laser applications. Synthesized via liquid phase formation (LPF), our ultra-high purity Hafnia exhibits the highest refractive index and minimum absorption at 224 nm, as well as the highest laser-induced damage thresholds (LIDT) deposited for 248 nm coatings.

In 1998, LTS introduced high purity Ta₂O₅ with controlled iron impurity content, ideal to produce EDFA switches which revolutionized commercial internet gears for communication companies.

In 2003, in collaboration with Korean electronics companies, LTS R&Ded the first-generation Indium Gallium Zinc Oxide (IGZO) chemicals for high-density thin film transistor materials. Currently, IGZO is used worldwide by the microelectronics industry as well for case studies in universities and research centers. IGZO and other similarly performing low-cost transparent conductive oxides (IZO, ITZO, ZTO, GTZO, etc.) have effectively replaced ITO and AZO.

Presently, LTS is engaged in the research, development, and production of next generation lithium-ion battery chemicals, high purity halides, and specialty suboxides. Furthermore, LTS has expanded its wings in the field of analytical services, including but not limited to, atomic absorption, SEM, XRD, GC, and GCMS which are aimed at providing technical information about products both internal and external.

NOVEL PROCEDURE FOR VACUUM INDUCTION MELTED (VIM) FLUORIDES

www.ltschem.com

UV – DUV – IR
COATING MATERIALS



LTS offers highest quality fluorides in form of powders, granules, pieces, pellets, disc, sputtering targets & custom made.



Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

📞 +1 (845) 293 0587
📞 (845) 818 3593
✉ info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.



Optics-UV-UV	CHEMICAL NAME	FORMULA	CAS#
	Aluminum Fluoride	AlF ₃	7784-18-1
	Cryolite (Sodium Aluminum Fluoride)	Na ₃ AlF ₆	13775-53-6
	Erbium Fluoride	ErF ₃	13760-83-3
	Gadolinium Fluoride	GdF ₃	13765-26-9
	Hafnium Fluoride	HfF ₄	13709-52-9
	Lanthanum Fluoride	LaF ₃	13709-38-1
	Lithium Fluoride	LiF	7789-24-4
	Magnesium Fluoride	MgF ₂	7783-40-6
	Neodymium Fluoride	NdF ₃	13709-42-7
	Scandium Fluoride (EUV)	ScF ₃	13709-47-2
	Sodium Fluoride	NaF	7681-49-4



Optics-IR	CHEMICAL NAME	FORMULA	CAS#
	Barium Fluoride	BaF ₂	7787-32-8
	Calcium Fluoride	CaF ₂	7789-75-5
	Cerium Fluoride	CeF ₃	7758-88-5
	Dysprosium Fluoride	DyF ₃	13569-80-7
	Ytterbium Fluoride	YbF ₃	13760-80-0
	Yttrium Fluoride	YF ₃	13709-49-4
	Zirconium Fluoride	ZrF ₄	7783-64-4

A solid solution for high-power laser (CO₂) applications

Optics-IR	For Non-Radiative Thorium Fluoride IR Coatings	
	YBC-375	IR and CO ₂ laser component applications
	YBC-905	Absorption band range (3.8-5.6μ) for CO ₂ lasers
	YBC-907	Low absorption NIR/IR & used in CO ₂ lasers

LTS produces the highest quality fluorides & YBC materials in form of powders, granules, pieces, pellets, sputtering targets and custom made. We pride ourselves on our reputation as a trusted producer of high purity Fluorides. For more details, please visit www.ltschem.com or contact sales@ltschem.com

Specialty Fluorides	CHEMICAL NAME	FORMULA	CAS#
	Ammonium Fluoride	NH ₄ F	12125-01-8
	Antimony trifluoride	SbF ₃	7783-56-4
	Bismuth Fluoride	BiF ₃	7787-61-3
	Cadmium Fluoride	CdF ₂	7790-79-6
	Cesium Fluoride	CsF	13400-13-0
	Chromium Fluoride	CrF ₃	7788-97-8
	Erbium Fluoride	ErF ₃	13760-83-3
	Europium Fluoride	EuF ₃	13765-25-8
	Holmium Fluoride	HoF ₃	13760-78-6
	Indium Fluoride	InF ₃	7783-52-0
	Lead Fluoride	PbF ₂	7783-46-2
	Manganese Fluoride	MnF ₃	7783-53-1
	Molybdenum Fluoride	MoF ₆	7783-77-9

Specialty Fluorides	CHEMICAL NAME	FORMULA	CAS#
	Niobium Fluoride	NbF ₅	7783-68-8
	Nickel Fluoride	NiF ₂	10028-18-9
	Potassium Fluoride	KF	7789-23-3
	Praseodymium Fluoride	PrF ₃	13709-46-1
	Rubidium Fluoride	RbF	13446-74-7
	Strontium Fluoride	SrF ₂	7783-48-4
	Samarium Fluoride	SmF ₃	13765-24-7
	Terbium Fluoride	TbF ₃	13708-63-9
	Tin Fluoride	SnF ₂	7783-47-3
	Titanium Fluoride	TiF ₃	13470-08-1
	Thulium Fluoride	TmF ₃	13760-79-7
	Vanadium Fluoride	VF ₃	10049-16-8
	Zinc Fluoride	ZnF ₂	7783-49-5

FLUORIDES

www.ltschem.com



BaF₂



CeF₃



DyF₃



GdF₃



LaF₃



NdF₃



YbF₃



LiF



Cryolite



NdF₃



NdF₃



PrF₃



YF₃

Sputtering Targets

SnO₂-SnF₂ | MgF₂ | CaF₂ | YF₃



Corporate Office
37 Ramland Road
Orangeburg, NY 10962

© Copyright reserved by LTS Research Laboratories, Inc.

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

DFM GRADE FLUORIDES

DFM FLUORIDES

Since 1992, LTS has been producing mil-spec compliant fluoride materials using the Direct Fluorination Method (DFM).

LTS produces the highest quality fluorides available in the industry: Our novel DFM process allows for the production of extremely pure compounds with superior deposition properties.

Fluoride compounds produced via hydrofluoric acid (HF) reactions have impurities in the precipitated compound which are not easy to purify out.

The Direct Fluoridation Method (DFM) is a specialized process defined by a high temperature plasma phase reaction of two or three components to increase the purity, viscosity, and consistency of the material. Then, secondary melting in fluorine gas atmosphere compensates for fluorine stoichiometry deficiencies.

The process is costly, cumbersome, and occasionally non-deployable in the cases of scandium fluoride (ScF_3), aluminum fluoride (AlF_3), cryolite (Na_3AlF_6), and a few other Rare Earth solutions of fluorides. LTS employs the DFM process in its production of ultra-high purity fluorides such as LaF_3 , GdF_3 , NdF_3 , LiScF_4 , CaF_2 , and MgF_2 production for DUV-NIR applications, as well as YbF_3 , YF_3 , BaF_2 , CeF_3 , and our thorium fluoride (ThF_4) replacement chemicals, solid solutions of YBC fluorides for IR applications.

The process effectively removes contaminants as well as trapped gases. The result is a significantly purer material that undergoes faster, cleaner deposition and ultimately provides a better optical coating.



YBC MATERIALS SPECIALIZED

YBC DFM is a highly preferred category of low-index materials transparent from the NIR to IR regions of the spectrum. YBC DFM materials are recommended for multilayer coatings in AR applications in the 2,000-12,000 nm region, including AR, bandpass, and dichroic filters. They are also suitable for laser coating applications.

YBC-375: The stoichiometry of this material has been optimized for easy deposition onto Ge and ZnSe substrates, making YBC-375 highly suitable for All IR and CO_2 laser component applications.

YBC-905: The stoichiometry of this material has been optimized to form a superior durable coating onto the substrates used in the CO_2 laser applications; however, a high quality deposition is more difficult to achieve than with YBC-375. In addition, YBC-905 cannot be used in high humidity environments or applications around the 3.8 and 5.6 micron range as it has absorption bands in that region of the spectrum.

YBC-907: The stoichiometry of this material has been optimized for extremely low absorption in NIR/IR applications. It is mildly toxic but outperforms radioactive thorium fluoride, making YBC-907 the superior material for use in CO_2 laser component films.



YBC COMPOUNDS

PURITY

99.995%

YBC DFM®, a brand new compound capable of replacing extremely radioactive Thorium Fluoride in its entirety, is a highly preferred low-index material transparent from the UV to IR region of the spectrum.

YBC 375 and YBC 905 are recommended for single-layer and multilayer coatings for usage in subtropical zones

YBC 907 is recommended for multilayer coating.



YBC-375



YBC-905



YBC-907

IMPURITY PROFILE IN PPM

FE <3	CU <1	MN <1	TI <2	NI <1	V <1	MO <1	AL <3	CO <2	NB <2	CR <2	PB <2	SI <5
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

Refractive index	1.51 at 500 nm
Transparency range	200 – 14,000 nm
Melting point	1,382 °C
Evaporation Temperature	1,100-1,500 °C
Density	4.45 g/cc
Solubility	Insoluble in water Slightly soluble in dilute acids
Abrasion	Moderately dense
Humidity	Mildly hygroscopic

PROPERTIES OF THE THIN FILM

Transparency Range	200-14,000 nm
Refractive Index	
at 220 nm	1.55
at 550 nm	1.51
at 1,000 nm	1.4
at 8,000 nm	1.37
at 10,000 nm	1.32
at 12,000 nm	1.30

Chemical Analysis: Available upon request

AVAILABILITY

- » 3~ 4g, 6-8 x 10 mm melted pellet
- » 1-4, 3-6 mm granules
- » <-100 mesh powder

DEPOSITION SUGGESTIONS

The suggested evaporation temperature of YBC is 1100-1500 °C. E-beam or resistance-heated sources can be used. For E-beam evaporation, molybdenum, tantalum, or platinum boats are suggested. The recommended substrate temperature is 100-300 °C, with a chamber pressure of less than 1×10^{-5} mbar at an evaporation rate of 1.5 - 2 nm/sec. Since YBC is DFM® grade material, no outgassing occurs, and deposition can therefore be made at a higher rate.

THORIUM FREE CO₂ LASER

Optical Properties

The transparency range of the compound is 200 - 14,000 nm. The refractive index in the visible (500 nm) spectrum is 1.51. At 10,000 nm, the index is 1.33.

Applications in Multilayer Coatings

YBC is recommended as a component in multilayer coatings for AR, bandpass, and dichroic filters. YBC exhibits low stress and good adhesion to ZnS, ZnSe, Ge, and many fluoride compounds. The microstructure of the deposited coating is amorphous, and the films are relatively soft.

Material Design, Purity, and Advantages

YBC compounds are produced through DFM® in a controlled, fluoride-based atmosphere. X-ray diffraction analysis then identifies the high-purity YBC compounds. The specification table shows the typical spectrographic analysis results of YBC. Since YBC is non-radioactive, it does not require special environmental safeguards like Thorium fluoride does. Thus, the material is very safe to use.

RECOMMENDED EVAPORATION TECHNIQUES

RESISTANCE EVAPORATION

Source **Molybdenum or Platinum or Tantalum boat**

Evaporation Temperature **1100° C**

Substrate temperature **150-280 °C**

Pressure **< 1.10⁻⁵ mbar**

Evaporation rate **1.5 - 2 nm/sec**

Refractive Index:

At 220 nm **1.55**

At 550 nm **1.51**

At 8,000 nm **1.37**

At 10,600 nm **1.32**

ELECTRON-BEAM EVAPORATION

Evaporator **Leybold A 700 Q E-beam Evaporator ESV 6, 8 Kv**

Acceleration Voltage, liquid nitrogen cooled baffle

Evaporation Temperature **1100 - 1500 °C**

Substrate Temperature **150 - 280 °C**

Pressure **< 5.10⁻⁵ mbar**

Deposition rate **1.5 - 2 nm/sec**

Transparency Range **200 - 14,000 nm**

Scatter **very low**

Adhesion and Stress Thickness Threshold **2,000 nm (ZnS)**

Absorption at 10,600 nm for QW (%) **0.11**

Loss of Transmission (%) at 12,000 nm **<2.5**



Corporate Office
37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

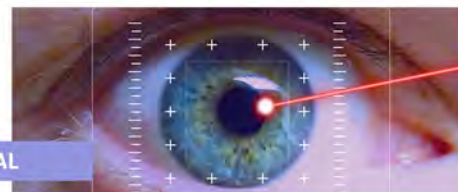
+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.

COSMETOLOGY



MEDICAL



INDUSTRIAL



INFRARED NAVIGATION



HIGH POWER LASER





Corporate Office
37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

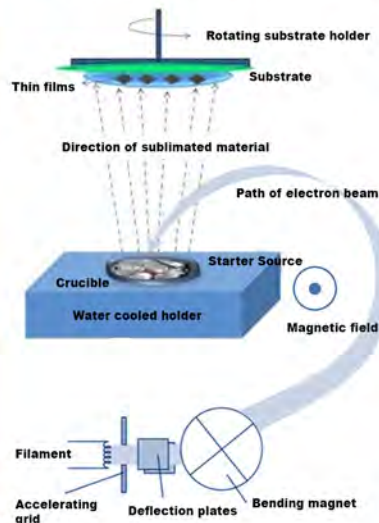
www.ltschem.com
Application example: Architectural glass

© Copyright reserved by LTS Research Laboratories, Inc.

EVAPORATION MATERIALS

STARTER SOURCES

Electron beam evaporation is a form of physical vapor deposition (PVD) technique that employs an electron beam to vaporize a source material and deposit thin films onto a substrate.



The fundamental components of e-beam evaporation consist of an electron gun, a crucible where the source material is positioned, and a vacuum chamber that regulates the pressure throughout the entire process.

E-beam evaporation is particularly well-suited for the deposition of thin films composed of high-temperature metals and metal oxides, including gold, chromium, platinum, and silicon dioxide.

In contrast to other PVD methods, many e-beam systems feature multiple crucibles, allowing users to apply different coatings onto the substrate in a single operation. This capability sets it apart.

The primary advantages of e-beam evaporation encompass its high deposition rate, precise control, the ability to utilize source materials with elevated melting points, the production of high-purity coatings & uniform film deposition.

Various industries employ e-beam evaporation for the fabrication of optical components, as well as for the manufacturing of parts that require temperature and chemical resistance.

APPLICATIONS

The variety of materials compatible with e-beam evaporation makes the process incredibly versatile, enabling manufacturers to transform the properties of components and tailor them to meet certain requirements. E-beam evaporation is used in many industries, like aerospace, constructions, energy, automotive, and electronic sectors. Especially, EMI shielding, Electroluminescent diode displays, optical thin films ranging from laser optics, solar panels, eye glass and architectural glasses to give them the desired conductive, reflective, and transmissive qualities.

EVAPORATION MATERIALS

STARTER SOURCES

LTS Research Laboratories, Inc. manufactures superior quality E-beam deposition cones, starter sources for thin film industry. A range of sizes are offered in metal, oxide, suboxide, and fluoride forms. Although standard sizes are 2.2 cc, 7 cc, 13 cc, 15 cc, 20 cc, 40 cc, and 60 cc. We offer custom sizing and crucible design. Pre-melted suboxides of the following material are also available. We provide certificate of analysis data which includes structural and phase confirmation with compositional and particle size distribution to ensure that each material fulfills the product specification.



METAL		OXIDES	
Aluminum	Al	Aluminum Oxide	Al_2O_3
Chromium	Cr	Hafnium Oxide	HfO_2
Gold	Au	Indium Oxide	In_2O_3
Magnesium	Mg	Molybdenum Oxide	MoO_3
Nickel	Ni	Scandium Oxide	Sc_2O_3
Niobium	Nb	Silicon Oxide	SiO_2
Palladium	Pd	Tantalum Oxide	Ta_2O_5
Platinum	Pt	Titanium Oxide	TiO_2
Scandium	Sc	Tungsten Suboxide	WO_x
Tantalum	Ta	Zirconium Oxide	ZrO_2
Titanium	Ti		
Hafnium	Hf		
Vanadium	V		
FLUORIDES		ALLOYS	
Gadolinium Fluoride	GdF_3	Cobalt Chromium	Co/Cr
Magnesium Fluoride	MgF_2	Gold Germanium	Au/Ge
Ytterbium Fluoride	YbF_3	Gold Nickel	Au/Ni
		Nickel Palladium	Ni/Pd
		Nickel Vanadium	Ni/V



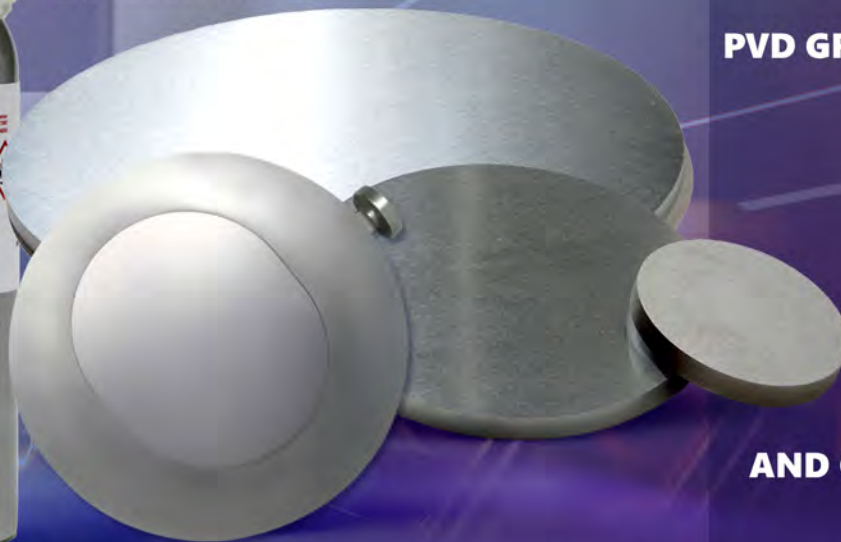


HAFNIUM

www.ltschem.com



Hafnium powder, sputtering targets and their assemblies



PROUD TO OFFER
ULTRA HIGH PURITY HAFNIUM
METAL AND ALLOYS

ZIRCONIUM CONTENT
AS LOW AS 200 PPM

AVAILABLE FORMS

**PVD GRADE GRANULES
PELLETS
DISK
INSERTS
TARGETS
INGOT
ROD
BAR
FOIL
POWDER
AND CUSTOM FORMS**

Hafnium metal is used in the thin film deposition for UV-NIR applications. Due to its high neutron absorbance, hafnium is widely used in nuclear reactors. Hafnium is predominantly used in filaments and electrodes, superalloys, gas-filled and incandescent lamps, vacuum tubes as a getter, control rods in nuclear power plants and as the electrode in plasma cutting.



Corporate Office
37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

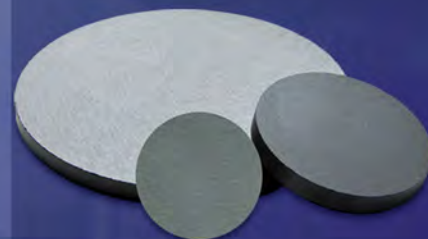
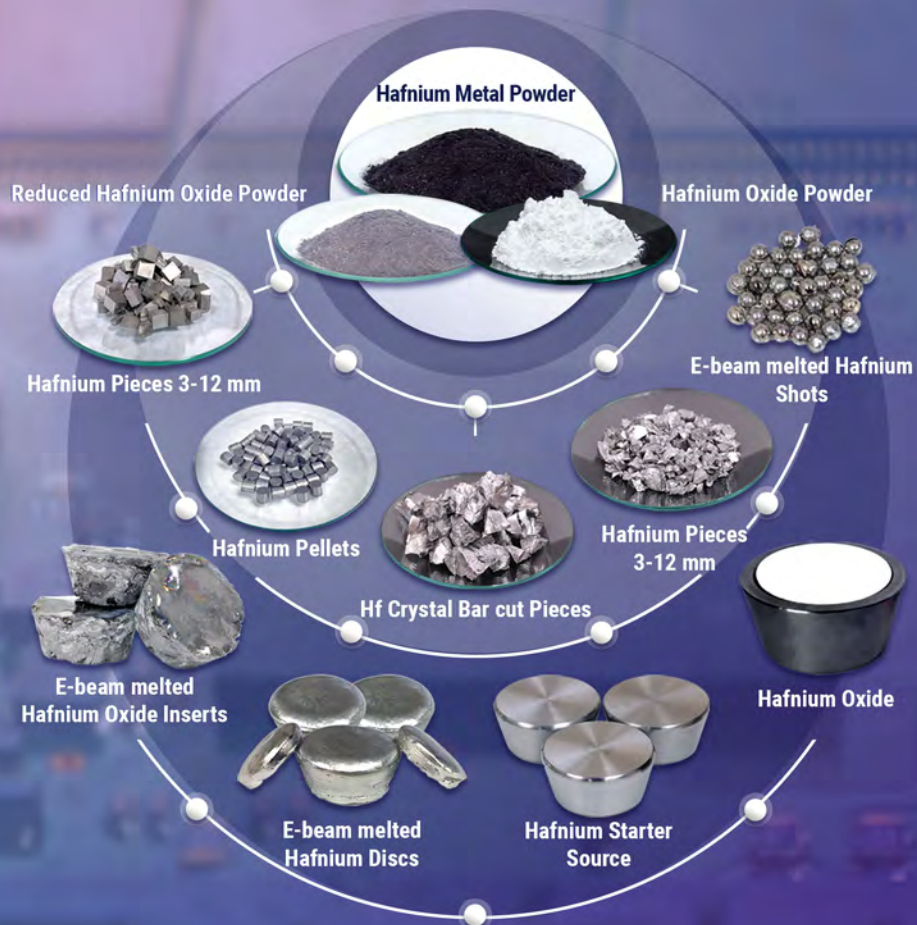
+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.

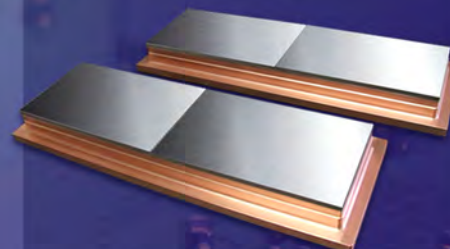
HAFNIUM METAL PRODUCTS



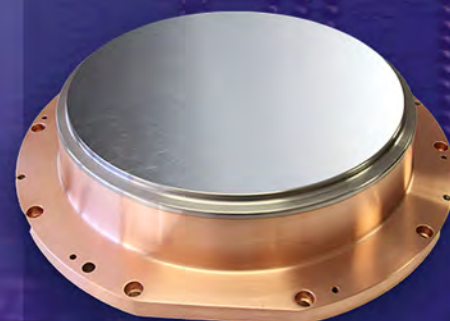
HAFNIUM



Targets of various sizes



Tiles Targets Assembly



Target Assembly



HAFNIUM

AND OTHER REFRACTORY COMPOUNDS

BORIDE

CHEMICAL NAME	FORMULA
Aluminum Boride	AlB ₃
Gold Boride	AuB
Barium Boride	BaB ₆
Calcium Boride	CaB ₃
Cobalt Boride	Co ₂ B
Cobalt Iron Silicon Boride	CoFeSiB
Chromium Boride	Cr ₃ B
Chromium Boride	CrB
Chromium Diboride	CrB ₂
Erbium Boride	ErB ₃
Iron Boride	Fe ₃ B
Iron Boride	FeB
Gadolinium Boride	GdB ₃
Hafnium Boride	HfB ₂
Lanthanum Boride	LaB ₃
Lutetium Boride	LuB ₃
Magnesium Boride	MgB ₂
Molybdenum Boride	Mo ₂ B
Molybdenum Boride	Mo ₃ B ₅
Molybdenum Boride	MoB
Molybdenum Boride	MoB ₂
Niobium Boride	NbB
Niobium Boride	NbB ₂
Neodymium Boride	NdB ₃
Nickel Boride	Ni ₃ B
Nickel Boride	Ni ₂ B
Nickel Boride	NiB
Praseodymium Boride	PrB ₃
Silicon Tetraboride	SiB ₄
Silicon Hexaboride	SiB ₆
Tantalum Boride	TaB
Tantalum Boride	TaB ₂
Titanium Boride	TiB ₂
Vanadium Boride	VB
Tungsten Boride	W ₂ B
Tungsten Boride	W ₃ B ₃
Tungsten Boride	WB
Zirconium Boride	ZrB ₂
Dysprosium Boride	DyB ₃
Europium Boride	EuB ₃
Thulium Boride	TmB ₃
Yttrium Boride	YB ₃
Iron Copper Boride	FeCuB
Aluminium dodecaboride	AlB ₁₂

NITRIDE

CHEMICAL NAME	FORMULA
Aluminum Nitride	AlN
Aluminum Nitride-Titanium Nitride	AlN-TiN
Barium Nitride	Ba ₃ N ₂
Boron Nitride	BN
Calcium Nitride	Ca ₃ N ₂
Cerium Nitride	CeN
Chromium Nitride	Cr ₃ N
Chromium Nitride	CrN
Copper Nitride	Cu ₃ N
Dysprosium Nitride	DyN
Erbium Nitride	ErN
Iron nitride	FeN
Iron Nitride	Fe ₃ N
Gallium Nitride	GaN
Gadolinium Nitride	GdN
Hafnium Nitride	HfN
Holmium Nitride	HoN
Indium Nitride	InN
Lanthanum Nitride	LaN
Lithium Nitride	Li ₃ N
Lutetium Nitride	LuN
Magnesium Nitride	Mg ₃ N ₂
Niobium Nitride	NbN
Neodymium Nitride	NdN
Nickel Nitride	NiN
Praseodymium Nitride	PrN
Scandium Nitride	ScN
Silicon Nitride	Si ₃ N ₄
Samarium Nitride	SmN
Tantalum Nitride	TaN
Terbium Nitride	TbN
Titanium Carbonitride	TiC/TiN
Titanium Nitride	TiN
Titanium Nitride	TiN-Ti
Thulium Nitride	TmN
Vanadium Nitride	VN
Ytterbium Nitride	YbN
Yttrium Nitride	YN
Zirconium Nitride	ZrN
Cobalt Nitride	CoN
Chromium Silicon Carbon Nitride	CrSiCN
Tungsten Nitride	W ₃ N
Tantalum Nitride	Ta ₃ N ₅

SILICIDE

CHEMICAL NAME	FORMULA
Calcium Silicide	CaSi ₂
Cerium Silicide	CeSi ₂
Cobalt Silicide	CoSi ₂
Chromium Silicide	Cr ₃ Si ₂
Chromium Silicide	CrSi ₂
Copper Silicide	Cu ₃ Si
Erbium Silicide	ErSi ₂
Iron Silicide	FeSi
Iron Silicide	FeSi ₂
Gadolinium Silicide	GdSi ₂
Hafnium Silicide	HfSi ₂
Lanthanum Silicide	LaSi ₂
Magnesium Silicide	Mg ₂ Si
Molybdenum Silicide	Mo ₂ Si ₃
Molybdenum Silicide	MoSi ₂
Niobium Silicide	Nb ₂ Si ₃
Niobium Silicide	NbSi ₂
Neodymium Silicide	NdSi ₂
Nickel Silicon Alloy	NiSi
Nickel Silicon Alloy	NiSi ₂
Praseodymium Silicide	PrSi ₂
Tantalum silicide	TaSi
Tantalum Silicide	TaSi ₂
Titanium Silicide	TiSi
Titanium Silicide	TiSi ₂
Vanadium Silicide	VSi
Vanadium Silicide	VSi ₂
Vanadium Silicide	W ₃ Si ₂
Tungsten Silicide	WSi ₂
Yttrium Silicide	YSi ₂
Zirconium Silicide	ZrSi ₂
Copper Silicide	Cu ₃ Si
Molybdenum Silicon	MoSi
Chromium (III) Silicide	Cr ₃ Si
Ruthenium Silicide	Ru ₂ Si ₃

CARBIDE

CHEMICAL NAME	FORMULA
Aluminum Carbide	Al ₄ C ₃
Boron Carbide	B ₄ C
Chromium Carbide	Cr ₃ C ₂
Iron Carbide	Fe ₃ C
Hafnium Carbide	HfC
Magnesium Carbide	Mg ₂ C ₃
Manganese Carbide	Mn ₂ C ₇
Molybdenum Carbide	Mo ₂ C
Niobium Carbide	NbC
Silicon Carbide	SiC
Tantalum Hafnium Carbide	Ta ₂ HfC ₃
Tantalum Carbide	TaC
Titanium Carbide	TiC
Vanadium Carbide	VC
Tungsten Carbide	W ₂ C
Tungsten Carbide	WC
Zirconium Carbide	ZrC
Tungsten Carbide	WC-Co
Titanium Aluminum Carbide	Ti ₂ AlC ₂
Calcium Carbide	CaC ₂
Molybdenum Carbide	MoC
Chromium Carbide	Cr ₃ C ₆
Titanium Silicon Carbide	Ti ₃ SiC ₂
Nickel Carbide	Ni ₃ C
Iron Chromium	
Doped Tungsten Carbide	WC-Fe-Cr

Corporate Office
37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

www.ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.

HAFNIUM AND OTHER REFRACTORY COMPOUNDS

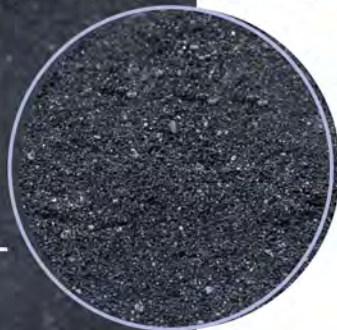


HAFNIUM

DIBORIDE (HfB_2)

HAFNIUM DIBORIDE is an ultra-high temperature (UHT) material renowned for its high temperature mechanical and chemical stability. Common applications include refractory linings, electrodes, microelectronic coatings, and cutting tools coatings. In aerospace applications, HfB_2 is proving to be a prime candidate as the leading-edge coatings for hypersonic and reentry-vehicle due to its high temperature thermal conductivity and strength.

As one of the only commercial manufacturers of HfB_2 , LTS offers single phase powder (in air-classified particle size distributions) suitable for 3D printing and thermal spray. We also manufacture pieces, granules, and sputtering targets targeted for the R&D and industrial coating application.



HAFNIUM

NITRIDE (HfN)

HAFNIUM NITRIDE is an interesting material with the highest melting temperature (3310°C) out of all known binary nitride compounds and remains chemically inert in extreme environments. HfN exhibits interesting electrical properties, such as its large phononic band gap, for semiconductor applications such as a hot carrier absorber in hot carrier solar cells. Like other hafnium refractory ceramics, HfN , with a peak hardness of 32 GPa, is also being investigated for aerospace applications such as the leading edge on reentry and hypersonic flight vehicles.

LTS offers HfN powder produced using our ultra-high purity low-Zr HfO_2 , refined to minimize residual oxygen. We then air classify the HfN powder to controlled particle size distributions for hard-coating thermal spraying applications. The same powder is used to produce HfN sputtering targets in diameters greater than 6 inches.



HAFNIUM

CARBIDE (HfC)

One of the most unique materials, HfC has the highest melting point (3990°C) of any known binary compounds. With a peak hardness of 17 GPa and excellent high temperature corrosion resistance, HfC is a choice material for hard coatings, including liners for combustion chambers, thrusters, and nozzles in rocket engines. Currently, HfC-SiC composites are being developed for to improve the oxidation resistance for aerospace and thermal ablation-related applications.

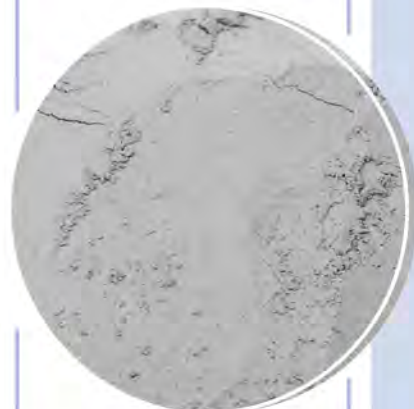
LTS manufactures large volumes of single-phase HfC available in controlled powder sizes for hard thin films and thermal spray coatings, as well as HfC sputtering targets for thin-film deposition. We custom-dope HfC sputtering targets to improve thin films for applications such as HfC-SiC and HfC-C-C composites.

HAFNIUM

SILICIDE (HfSi_2)

Amongst all the refractory silicides, HfSi_2 has a high melting point (1680°C), low resistivity, high resistance to oxidation in air, and relatively low density, making it suitable for bulk part production of electrothermal devices. HfSi_2 also is used in semiconducting CMOS devices as ohmic contacts, Schottky barriers, local interconnects, and gate electrodes, where it can be epitaxially grown on Si due to its orthorhombic crystalline phase.

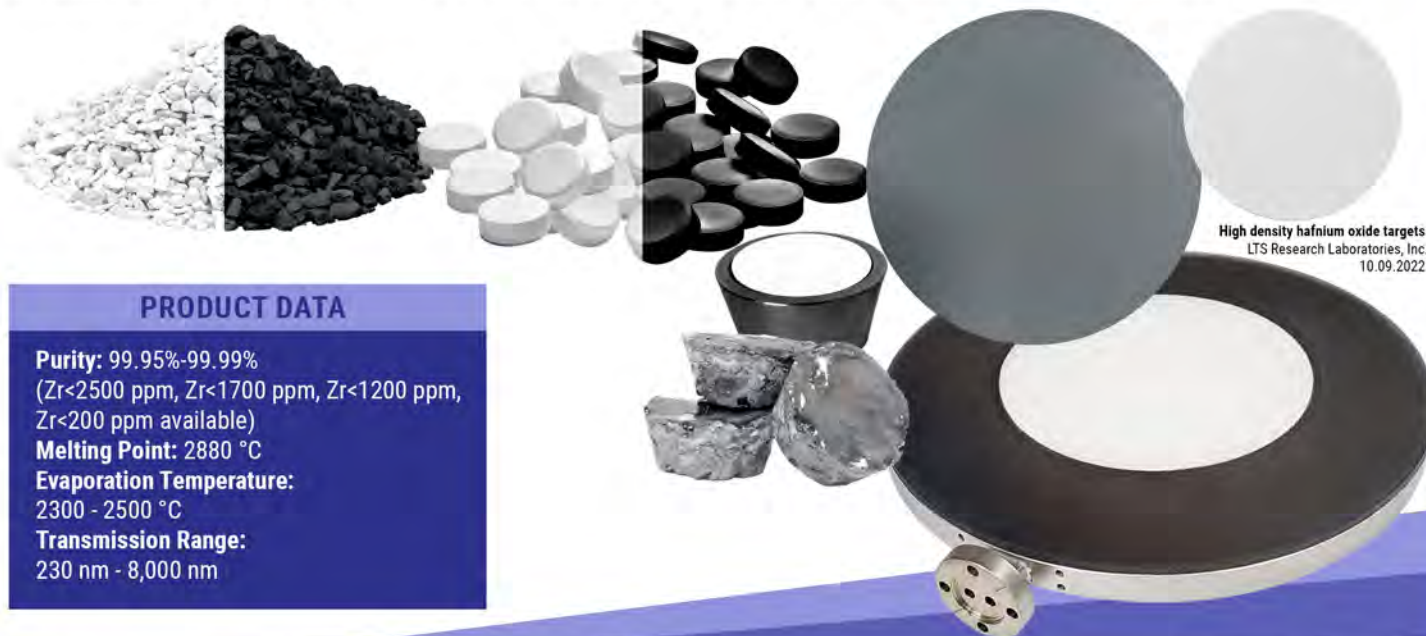
LTS specializes in manufacturing high purity HfSi_2 , containing low Zr content. HfSi_2 is available in all forms, including bulk powder, granules, and sputtering targets.



HAFNIUM OXIDE

LTS Research Laboratories, Inc. offers ultra-high purity hafnium oxide products (99.95% - 99.99%) with low Zr content (Zr<2500 ppm, Zr<1700 ppm, Zr<1200 ppm, Zr<200 ppm) and unique characteristics. Our hafnium oxide has the highest index and lowest absorption at 224 nm, is completely outgassed, and only requires 1/3rd the preconditioning time before deposition compared to other commercially available hafnium oxide products. Additionally, our hafnium oxide exhibits the highest Laser-Induced Damage Threshold (LIDT) qualifying it for excimer laser applications.

Our wide array of hafnium oxide products (CAS# 12055-23-1) includes E-beam reduced hafnium suboxide in pellets, pieces, disks, granules, sputtering targets, and pre-melted conical interests in various sizes for Telemark and Temescal crucible liners. All our HfO_2 products are supplied with a certification of analysis that includes structural, compositional & particle size distribution to ensure that each material fulfills product specifications.



High density hafnium oxide targets
LTS Research Laboratories, Inc.
10.09.2022

PRODUCT DATA

Purity: 99.95%-99.99%
(Zr<2500 ppm, Zr<1700 ppm, Zr<1200 ppm,
Zr<200 ppm available)
Melting Point: 2880 °C
Evaporation Temperature:
2300 - 2500 °C
Transmission Range:
230 nm - 8,000 nm



HAFNIUM OXIDE

www.ltschem.com

Hafnium oxide (HfO_2) is used for coatings in the near-UV (230 nm) to IR (8,000 nm) spectrum, due to its high-index and low absorption properties make it valuable for enhancing the performance of the optical system. Typically deposited as multilayer coatings with silicon dioxide (SiO_2), HfO_2 is proven for a wide range of applications such as IR mirror coatings, emitter wire coatings, achromatic beam splitting, and protective and polarizing coatings. Besides, HfO_2 is a high-k dielectric material with excellent thermal stability makes it suitable for various applications not limited to

- Gate dielectric in MOSFET
- Memory devices (ReRAM and FeRAM)
- Optical coatings
- Ceramic and refractory
- Capacitors
- Organic electronics

Corporate Office
 37 Ramland Road
 Orangeburg, NY 10962

+1 (845) 293 0587
 (845) 818 3593
 info@ltschem.com

R&D / Distribution center
 2001 Oaks Parkway
 Belmont, NC 28012



© Copyright reserved by LTS Research Laboratories, Inc.

UV optical
coatings



Beam
splitter



Memory
devices



Dielectric
coatings



MIM
Capacitor



Ceramics
&
Refractory





METAL HALIDES

Halide salts are chemical compounds composed of halogen ions combined with metal ions or other cations. Halogens belong to Group 17 of the periodic table and include fluorine (F), chlorine (Cl), bromine (Br), iodine (I), and astatine (At). Halide salts are typically ionic compounds with excellent conductivity, high melting points, and solubility in water.

LTS Research Laboratories, Inc. is the leading manufacturer and supplier of high-purity inorganic materials for optics, microelectronics, semiconductors, aerospace, automotive, medical, defense, crystal growth, and renewable energy industries.

With our 30+ years of experience in inorganic material production combined with our unique manufacturing technologies, excellent supply chain, and in-house advanced material characterization, LTS strives to produce state-of-the-art materials matched to your specifications. For instance, our R&D group at LTS has developed a complex halide, Cesium Samarium Iodide (CsSml₃) or Cesium Europium Bromide (CsEuBr₃) having great attention in medical imaging, solar cells, lasers, and infrared applications.

IODIDES		CHLORIDES		BROMIDES	
Aluminum Iodide	AlI ₃	Aluminum Chloride	AlCl ₃	Aluminum Bromide	AlBr ₃
Antimony Iodide	SbI ₃	Ammonium Chloride	NH ₄ Cl	Barium Bromide	BaBr ₂
Barium Iodide	BaI ₂	Antimony Chloride	SbCl ₃	Bismuth Bromide	BiBr ₃
Bismuth Iodide	BiI ₃	Barium Chloride	BaCl ₂	Cesium Bromide	CsBr ₂
Boron Iodide	BI ₃	Bismuth Chloride	BiCl ₃	Cobalt Bromide	CoBr ₂
Calcium Iodide	CaI ₂	Cadmium Chloride	CdCl ₂	Europium (III) Bromide	EuBr ₃
Cobalt Iodide	CoI	Calcium Chloride	CaCl ₂	Gadolinium Bromide	GdBr ₃
Cerium (III) Iodide	CeI ₃	Chromium Chloride	CrCl ₃	Hafnium Bromide	HfBr ₄
Cesium Iodide	CsI	Cerium Chloride	CeCl ₃	Potassium Bromide	KBr
Copper Iodide	CuI	Cesium Chloride	CsCl	Iron (II) Bromide	FeBr ₂
Europium Iodide	EuI ₂	Cobalt Chloride	CoCl ₂	Lead Bromide	PbBr ₂
Indium Iodide	IndI ₃	Dysprosium Chloride	DyCl ₃	Lithium Bromide	LiBr
Gallium Iodide	GalI ₃	Europium Chloride	EuCl ₃	Zirconium Bromide	ZrBr ₄
Gadolinium Iodide	GdI ₃	Gallium Chloride	GaCl ₃		
Germanium Iodide	GeI ₂	Germanium Chloride	GeCl ₄		
Lanthanum Iodide	LaI ₃	Gadolinium Chloride	GdCl ₃		
Lithium Iodide	LiI	Hafnium chloride	HfCl ₄		
Lutetium Iodide	LuI ₃	Iron Chloride	FeCl ₂		
Lead Iodide	PbI ₂	Magnesium Chloride	MnCl ₂		
Magnesium Iodide	MgI ₂	Potassium Chloride	KCl		
Potassium Iodide	KI	Sodium Chloride	NaCl		
Samarium Iodide	Sml ₃	Silicon Chloride	SiCl ₄		
Strontium Iodide	SrI ₂	Samarium Chloride	SmCl ₃		
Tantalum (V) Iodide	Tal ₅	Tin Chloride	SnCl ₂		
Terbium (III) Iodide	TbI ₃	Terbium Chloride	TbCl ₃		
Ytterbium Iodide	YbI ₂	Tungsten Chloride	WCl ₆		
Zinc Iodide	ZnI ₂	Tantalum Chloride	TaCl ₅		
Zirconium (IV) Iodide	ZrI ₄	Ytterbium Chloride	YbCl ₃		
		Yttrium Chloride	YCl ₃		

We offer high-purity single elements, compounds, alloys, and composite material from nearly every element on the periodic table in a variety of forms including powders, pieces, granules, sputtering targets and custom forms.

Cesium Samarium

Cobalt Iodide



METAL HALIDES

FORM

All our ultrahigh purity halide salts are available in ultra-dry and anhydrous forms and are packed in argon purged ampoules to prevent hydration. They are typically in the form of -10 mesh beads and -100 mesh powder. Typical purities are +99.999%

MBE and specialty metals



HALIDES

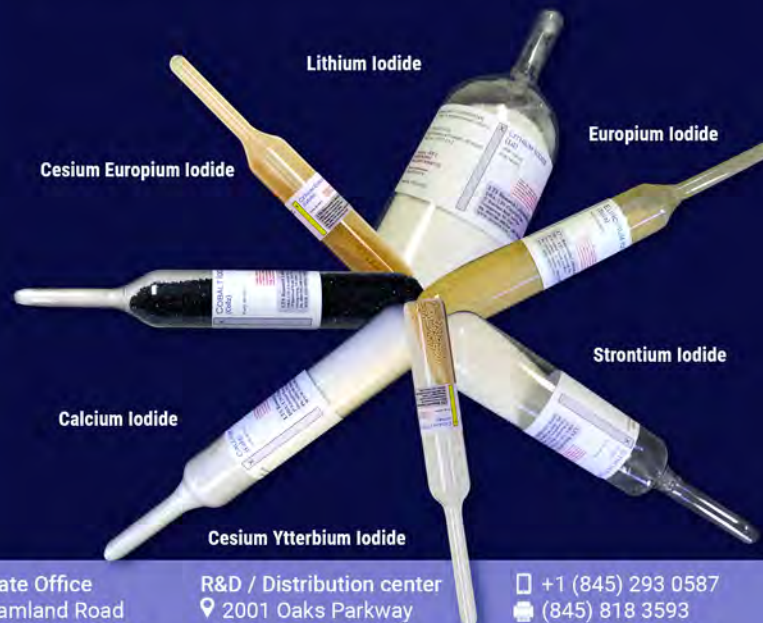


www.ltschem.com

APPLICATIONS

These halides are used as chemical reagents and catalysts in chemical synthesis. Some are used in photographic and x-ray films, optical polarizing films for LCD displays, flame retardants, and disinfectants and biocides for water and agriculture.

LTS pioneered the research and development of both standard as well as custom, designed iodides, chlorides, and bromides products including, but not limited to:



Corporate Office
 37 Ramland Road
 Orangeburg, NY 10962

R&D / Distribution center
 2001 Oaks Parkway
 Belmont, NC 28012

+1 (845) 293 0587
 (845) 818 3593
info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.



CHLORIDES

When halogens react with metals, they form compounds called halides. Many naturally occurring halides have industrial, household, and medical applications.

Among them, chlorides are one of the most abundant halogen compounds owing to the higher solar abundance of Cl compared to other halogens and it plays a major role in the manufacture of thousands of products that we depend on day today's life.

The chlorides have been used as raw material in industrial applications and manufacturing processes and they are used in superconductors, lasers, magnets,

fertilizers, superalloys, household bleach, soaps, detergents, dyes, paper, plastics, rubber, polyester, and as catalyst in the production of petroleum and synthetic products, etc.

We offer you high-quality chlorides exclusively listed in the table and whether you need minor variations from a standard formulation or a completely custom chemical system:

LTS is your source



Praseodymium
(III) chloride



Chromium
Chloride



Cobalt (II)
Chloride



Manganese
(II) Chloride



Gallium (III)
Chloride beads



Thulium
Chloride



Copper(II)
chloride



Samarium (III)
Chloride



Rhenium
chloride





SPECIALTY CHLORIDES

WE WELCOME ANY REQUEST FOR MATERIALS NOT INCLUDED IN THIS LIST



Alkali metals
bulk Chlorides



Alkali earth
metals Chlorides



Transition
metals Chlorides



Metals
Chlorides



Metalloid
Chlorides



Rare earth
Chlorides

CHEMICAL NAME	FORMULA	CAS #	CHEMICAL NAME	FORMULA	CAS #
Aluminum chloride	AlCl ₃	7446-70-0	Lutetium Chloride	LuCl ₃	100099-66-8
Antimony chloride	SbCl ₃	10025-91-9	Lutetium (III) Chloride hexahydrate	LuCl ₃ ·6H ₂ O	15230-79-2
Antimony (V) chloride	SbCl ₅	7647-19-9	Magnesium chloride	MgCl ₂	7786-30-3
Barium chloride	BaCl ₂	10361-37-2	Magnesium chloride hexahydrate	MgCl ₂ ·6H ₂ O	7791-18-6
Barium chloride dihydrate	BaCl ₂ ·2H ₂ O	10326-27-9	Manganese (II) chloride	MgCl ₂ ·6H ₂ O	7773-01-5
Bismuth (III) chloride	BiCl ₃	7787-60-2	Manganese (II) chloride hydrate	MnCl ₂ ·xH ₂ O	73913-06-1
Cadmium chloride	CdCl ₂	10108-64-2	Molybdenum (V) chloride	MoCl ₅	10241-05-1
Calcium chloride	CaCl ₂	10043-52-4	Neodymium (III) chloride	NdCl ₃	10024-93-8
Calcium chloride hydrate	CaCl ₂ ·xH ₂ O	22691-02-7	Niobium (V) chloride	NbCl ₅	10026-12-7
Cerium (III) chloride	CeCl ₃	7790-86-5	Potassium chloride	KCl	7440-40-7
Cerium (III) chloride heptahydrate	CeCl ₃ ·7H ₂ O	18618-55-8	Praseodymium (III) chloride	PrCl ₃	10361-79-2
Cesium chloride	CsCl	7647-17-8	Praseodymium (III) chloride hydrate	PrCl ₃ ·xH ₂ O	19423-77-9
Chromium (II) chloride	CrCl ₂	10049-05-5	Rhenium (III) chloride	ReCl ₃	13569-63-6
Chromium (III) chloride	CrCl ₃	10025-73-7	Rhenium (V) chloride	ReCl ₅	13596-35-5
Cobalt (II) chloride	CoCl ₂	7646-79-9	Rubidium chloride	RbCl	7791-11-9
Cobalt (II) chloride hexahydrate	CoCl ₂ ·6H ₂ O	7791-13-1	Samarium (II) chloride	SmCl ₂	13874-75-4
Copper (I) chloride	CuCl	7758-89-6	Samarium (III) chloride	SmCl ₃	10361-82-7
Copper (II) chloride	CuCl ₂	7447-39-4	Samarium (III) chloride hexahydrate	SmCl ₃ ·6H ₂ O	13465-55-9
Silver chloride	AgCl	7783-90-6	Gold (III) chloride	AuCl ₃	13453-07-1
Dysprosium (III) chloride	DyCl ₃	10025-74-8	Scandium (III) chloride	ScCl ₃	10361-84-9
Dysprosium (III) chloride hydrate	DyCl ₃ ·xH ₂ O	15059-52-6	Scandium (III) chloride hexahydrate	ScCl ₃ ·6H ₂ O	20662-14-0
Erbium (III) chloride	ErCl ₃	10138-41-7	Silicon (IV) chloride	SiCl ₄	10026-04-7
Erbium (III) chloride hydrate	ErCl ₃ ·xH ₂ O	19423-85-9	Sodium chloride	NaCl	7647-14-5

CHEMICAL NAME	FORMULA	CAS #	CHEMICAL NAME	FORMULA	CAS #
Europium (III) chloride	EuCl ₃	10025-76-0	Strontium chloride	SrCl ₂	10476-85-4
Europium (III) chloride hexahydrate	EuCl ₃ ·6H ₂ O	13759-92-7	Tantalum (V) chloride	TaCl ₅	7721-01-9
Gadolinium (III) chloride	GdCl ₃	10138-52-0	Tellurium (IV) chloride	TeCl ₄	10026-07-0
Gadolinium (III) chloride hexahydrate	GdCl ₃ ·6H ₂ O	13450-84-5	Terbium (III) chloride	TbCl ₃	10042-88-3
Gallium (II) chloride	Ga ₂ Cl ₄	24597-12-4	Terbium (III) chloride hexahydrate	TbCl ₃ ·6H ₂ O	13798-24-8
Gallium (II) chloride	GaCl ₂	24597-12-4	Thallium chloride	TlCl	7791-12-0
Gallium (III) chloride	GaCl ₃	13450-90-3	Thulium (III) chloride	TmCl ₃	13537-18-3
Germanium (IV) chloride	GeCl ₄	10038-98-9	Thulium (II) chloride hexahydrate	TmCl ₂ ·6H ₂ O	1331-74-4
Hafnium chloride	HfCl ₄	13499-05-3	Thulium (III) chloride hydrate	TmCl ₃ ·xH ₂ O	19423-86-0
Hafnium oxychloride	HfOCl ₂	14456-34-9	Tin (II) chloride	SnCl ₂	7772-99-8
Holmium Chloride Hydrate	HoCl ₃ ·xH ₂ O	14914-84-2	Tin (II) chloride dihydrate	SnCl ₂ ·2H ₂ O	10025-69-1
Holmium (III) chloride	HoCl ₃	10138-62-2	Tin (IV) chloride	SnCl ₄	7646-78-8
Holmium (III) chloride hexahydrate	HoCl ₃ ·6H ₂ O	14914-84-2	Titanium (IV) chloride	TiCl ₄	7550-45-0
Indium chloride	InCl	13465-10-6	Tungsten (VI) chloride	WCl ₆	13283-01-7
Indium (III) chloride	InCl ₃	10025-82-8	Ytterbium (III) chloride	YbCl ₃	10361-91-8
Indium (III) chloride hydrate	InCl ₃ ·xH ₂ O	143983-91-9	Ytterbium (III) chloride hydrate	YbCl ₃ ·xH ₂ O	19423-87-1
Iron (II) chloride	FeCl ₂	7758-94-3	Yttrium (III) chloride	YCl ₃	10361-92-9
Iron (II) chloride tetrahydrate	FeCl ₂ ·4H ₂ O	13478-10-9	Yttrium (III) chloride hydrate	YCl ₃ ·xH ₂ O	12741-05-8
Lanthanum (III) chloride	LaCl ₃	10099-58-8	Zinc chloride	ZnCl ₂	7646-85-7
Lanthanum (III) chloride heptahydrate	LaCl ₃ ·7H ₂ O	10025-84-0	Zinc chloride hydrate	ZnCl ₂ ·xH ₂ O	29604-34-0
Lithium chloride	LiCl	7447-41-8	Zirconium dichloride oxide hydrate	ZrOCl ₂ ·xH ₂ O	15461-27-5
Lithium chloride hydrate	LiCl·xH ₂ O	85144-11-2	(metals basis excluding Hf)		
Lithium chloride monohydrate	LiCl·H ₂ O	16712-20-2	Zirconium (IV) chloride	ZrCl ₄	10026-11-6

CHLORIDE PRODUCTS



www.ltschem.com

Corporate Office
37 Ramland Road
Orangeburg, NY 10263

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.



- Wear-resistant tools, cutting tools, and coatings for abrasive steel bearings
- As an intermediate in chemical research, pharmaceutical intermediates, and organic intermediates
- Used in rocket nozzles, especially for re-entry space rocket nose cones
- As a desulfurizer, dehydrant of steel, fuel in steel making, powerful deoxidizer, and as a source of acetylene gas
- Excellent starting material for the preparation of ethylene, chloroprene rubber, acetic acid, and dicyandiamide
- Best refractory coatings in nuclear reactors and surface treatment of metal components via thermal spraying process
- Superior hard alloy additive to produce arc-welding rods and in corrosion-resistant steel
- Improves the property of the cermets
- Anode materials for lithium-ion batteries and supercapacitors

Carbides have gained significant attention due to their remarkable properties, which include high conductivity, chemical stability, corrosion resistance, thermal stability, and excellent electronic properties. They are also known for their catalytic activity, which has fascinated both industrial and research sectors. Metal carbides, in particular, have the potential to replace traditional nickel catalysts in dry reforming processes due to their stability and activity.

APPLICATIONS



Welding material



Aerospace



TiCN cermet rod



Hard thin film



CNC cutting tool



Carbide cement



Wear resistant material



Thermal spraying

Corporate Office
37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

CARBIDES

CHEMICAL NAME	FORMULA	CAS #	CHEMICAL NAME	FORMULA	CAS #
Aluminum Carbide	Al_4C_3	1299-86-1	Magnesium Carbide	Mg_2C_3	12151-74-5
Boron Carbide	B_4C	12069-32-8	Molybdenum Carbide	Mo_2C	12069-89-5
Calcium Carbide	CaC_2	75-20-7	Niobium Carbide	NbC	12069-94-2
Silicon Carbide	SiC	409-21-2	Nickel Carbide	Ni_3C	12710-36-0
Hafnium Carbide	HfC	12069-85-1	Titanium Carbide	TiC	12070-08-5
Tantalum Carbide	TaC	12070-06-3	Tungsten Carbide	WC	12070-12-1
Chromium Carbide	$Cr_{23}C_6$	12105-81-6	Vanadium Carbide	VC	12070-10-9
Iron Carbide	Fe_3C	12011-67-5	Boron Carbide doped Aluminum	AlB_4C	
Silicon Carbide	SiC	409-21-2	Scandium Carbide	Sc_2C	
Titanium Aluminum Carbide	Ti_3AlC_2	196506-01-1	Tantalum Hafnium Carbide	Ta_4HfC_5	71243-79-3
Tungsten Carbide	WC	12070-13-2	Titanium Silicone Carbide	Ti_3SiC_2	12202-82-3
Zirconium Carbide	ZrC	12070-14-3	Tungsten Carbide – Cobalt	$WC-Co$	
Tungsten Carbide – Cobalt	$WC-Co$		Manganese Carbide	$Mn_{23}C_7$	

WE WELCOME ANY REQUESTS FOR MATERIALS NOT INCLUDED IN THIS LIST

B_4C sputtering target

HfC discs

TaC granules

NITRIDES

www.ltschem.com

APPLICATIONS

Arc-welding rods



Aerospace components



Microelectronics



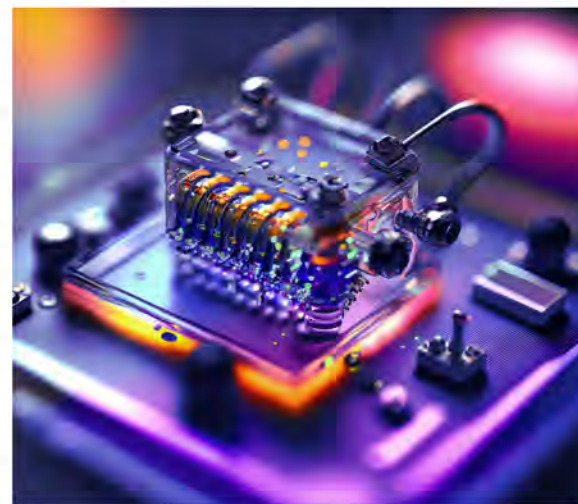
Radar components



- Superconductor, arc-welding rods/steel & absorbing anti-reflective coatings (NbN)
- Coating medical devices, industrial parts, automotive/aerospace components suitable for high wear and corrosive environments (ZrN)
- Raw material in organic synthesis, pharmaceuticals, Agrochemicals, biological materials, gate electrode in transistors, Low-barrier Schottky diode, wear-resistant coating (TiN)
- Production of light-emitting diode phosphors (Ca_3N_2)
- Barrier layer between conductive metals/dielectric insulator films (TaN)
- Cosmetics, laser nozzles, dental cements, nuclear shielding, radar components, high temperature lubricants/valves, and refractory applications (BN)
- Ceramic industry, ultraviolet optoelectronics, steel production, dielectric layers in optical storage media, circuit carrier in semiconductors, as a heat-sink in light-emitting diode lighting technology (AlN)
- Creation of ferrofluids, a liquid rocket fuel (FeN)
- Stainless steel, corrosion resistant steel, alloy steel (CrN)

The demand for new catalysts to replace noble metals, and the success of boron and carbon nitrides, have brought renewed attention to metal nitrides. Recently, semiconductor industries and research groups have explored various metal nitrides for use in heterogeneous catalysis, optoelectronic devices, batteries, transistors, and sensing devices.

Metal nitrides have gained substantial recognition due to their unique electronic structure, high melting point, wide bandgap, enhanced chemical stability, outstanding mechanical robustness, and captivating electrocatalytic activity. Due to these intriguing features, nitride compounds find numerous applications as follows:



Corporate Office
37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.



NITRIDES



Boron Nitride rods & ring

HfN granules

Si₃N₄ Sputtering Target

TiN Target

CHEMICAL NAME	FORMULA	CAS #	CHEMICAL NAME	FORMULA	CAS #
Zirconium nitride	ZrN	25658-42-8	Tantalum nitride	TaN	1203362-4
Calcium nitride	Ca ₃ N ₂	12013-82-0	Titanium nitride	TiN	25583-20-4
Boron nitride	BN	10043-11-5	Niobium nitride	NbN	24621-21-4
Aluminum nitride	AlN	24304-22-5	Dysprosium nitride	DyN	12019-88-4
Aluminum oxynitride	Al ₂₃ O ₂₇ N ₅	12633-97-5	Erbium nitride	ErN	12020-21-2
Vanadium nitride	VN	24646-85-3	Gallium nitride	GaN	25617-97-4
Chromium nitride	CrN	24094-93-7	Gadolinium nitride	GdN	25764-15-2
Hafnium nitride	HfN	25817-87-2	Indium nitride	InN	25617-98-5
Holmium nitride	HoN	12029-81-1	Lanthanum nitride	LaN	25764-10-7
Lithium nitride	LiN	26134-62-3	Lutetium nitride	LuN	12125-25-6
Magnesium nitride	Mg ₃ N ₂	121057-71-5	Neodymium nitride	NdN	25764-11-8
Nickel nitride	NiN		Praseodymium	PrN	25764-09-4
Scandium nitride	ScN	664347-12-0	Silicon nitride	Si ₃ N ₄	12033-89-5
Samarium nitride	SmN	25764-14-1	Terbium nitride	TbN	12033-64-6
Copper nitride	Cu ₃ N	1308-80-1	Thulium nitride	TmN	12033-68-0
Ytterbium nitride	YbN	24600-77-9	Cerium nitride	CeN	12013-82-0
Zinc nitride	Zn ₃ N ₂	1313-49-1	Aluminum nitride-Titanium nitride	AlN-TiN	
Silicon aluminum oxynitride	SiAlON		Cobalt nitride	CoN	
Chromium silicon carbon nitride	CrSiCN		Iron nitride	FeN	
Aluminium scandium nitride	AlScN		Lithium Phosphorus oxynitride	LiPON	

WE WELCOME ANY REQUESTS FOR MATERIALS NOT INCLUDED IN THIS LIST



REFRACTORY BORIDES

REFRACTORY BORIDES

Boride ceramic materials are classified as ultra-high temperature (UHT) materials due to their exceptional melting point. Transition metal borides like Hafnium (Hf), Titanium (Ti), Niobium (Nb) and Zirconium (Zr) have the highest known point of melting, making them ideal for aerospace and defense applications. These materials tend to possess high thermal stability and resistance to corrosion.

LTS Research Laboratories, Inc. produces **Borides** for customized target products made of high-purity raw material powder with super fine grain size. LTS is the largest manufacturer of HfB_2 . It is used in wear resistant coatings and also employed as a nuclear reactor control rod. Additionally, they are used in hypervelocity re-entry vehicles like ICBM (Intercontinental ballistic Missile) heat shields or aerodynamic leading edges. It is useful in the preparation of high temperature composites in conjunction with Silicon Carbide (SiC).

Borides have excellent strength, and resist deformation, resist corrosion, heat shock, and creep resistance of **boride** makes it eligible for usage in gas turbines and rockets that require materials to work at high temperatures for a long time. These features also make it eligible for use in electrical devices, wear-resistant coatings, cathode material, and crucibles with their excellent electrical conductivity, high melting point, and corrosion resistance.

Various alloys or cermets based on **Borides Powder** can be used to manufacture rocket structural components, aviation equipment components, turbine components, and structural parts of nuclear energy devices.

www.ltschem.com



Corporate Office
37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
2001 Oaks Parkway
Belmont, NC 28012

+1 (845) 293 0587
(845) 818 3593
info@ltschem.com

REFRACTORY BORIDES

We welcome any requests
for materials
not included in this list

Borides powder

CHEMICAL NAME	FORMULA	CAS #	CHEMICAL NAME	FORMULA	CAS #
Chromium Boride	CrB	12006-79-0	Manganese Boride	MnB	12045-15-7
Dysprosium Boride	DyB6	12008-04-7	Manganese Boride	MnB2	12228-50-1
Europium Boride	EuB6	12008-05-8	Molybdenum Boride	Mo2B	12006-99-4
Hafnium Boride	HfB2	12007-23-7	Molybdenum Boride	Mo2B5	12007-97-5
Niobium Boride	NbB2	12007-29-3	Molybdenum Boride	MoB	12006-98-3
Thulium Boride	TmB6	12046-55-8	Molybdenum Boride	MoB2	12007-27-1
Yttrium Boride	YB6	12008-32-1	Niobium Boride	NbB	12045-19-1
Aluminium dodecaboride	AlB12	12041-54-2	Niobium Boride	NbB2	12007-29-3
Barium Boride	BaB6	12046-08-1	Neodymium Boride	NdB6	12008-23-0
Calcium Boride	CaB6	12007-99-7	Nickel Boride	Ni2B	12007-01-1
Cerium boride	CeB6	12008-02-5	Nickel Boride	Ni3B	12007-02-2
Cobalt Boride	Co2B	12045-01-1	Nickel Boride	NiB	12007-00-0
Cobalt Boride	Co3B	12006-78-9	Praseodymium Boride	PrB6	12008-27-4
Chromium Boride	Cr2B	12006-80-3	Silicon Tetraboride	SiB4	12007-81-7
Chromium Boride	CrB	12006-79-0	Silicon Hexaboride	SiB6	12008-29-6
Chromium Diboride	CrB2	12007-16-8	Samarium Boride	SmB6	12008-30-9
Dysprosium Boride	DyB6	12008-04-7	Tantalum Boride	TaB	12007-07-7
Erbium Boride	ErB4	12310-44-0	Tantalum Boride	TaB2	12007-35-1
Europium Boride	EuB6	12008-05-8	Titanium Boride	TiB2	12045-63-5
Iron Boride	Fe2B	12006-85-8	Thulium Boride	TmB6	12046-55-8
Iron Boride	FeB	12006-84-7	Vanadium Boride	VB	12045-27-1
Iron Copper Boride	FeCuB		Vanadium Boride	VB2	12007-37-3
Gadolinium Boride	GdB6	12008-06-9	Tungsten Boride	W2B	12007-10-2
Hafnium Boride	HfB2	12007-23-7	Tungsten Boride	W2B5	12007-98-6
Lanthanum Boride	LaB6	12008-21-8	Tungsten Boride	WB	12007-09-9
Lutetium Boride	LuB4	12688-52-7	Yttrium Boride	YB6	12008-32-1
Magnesium Boride	MgB2	12007-25-9	Zirconium Boride	ZrB2	12045-64-6



SILICIDE

www.ltschem.com

SILICIDE

The semiconductor industry has produced some exciting and dramatic advances in technology whose impact has been felt universally. Integration of an increasing number of devices on single microchips has necessitated the use of specialized and highly pure materials. Silicides are now being utilized to overcome some of these limitations in interconnect technology.

Metallic silicide are a kind of ceramic materials with outstanding heat resistance and oxidation resistance properties. Its usage has primarily focused on fundamental properties such as electrical resistivity, high-temperature stability, and corrosion resistance for high-temperature anti-oxidation coatings. These features make Silicides compounds play a important role in application as:

- Transistors and microelectronics
- Wafers for semiconductors
- Photovoltaics
- Components of integrated circuits
- Thermoelectric devices
- Heating Element for Ceramic Heater (MoSi_2)
- Oxidation-resistant surface in a low pressure plasma spraying due to low melting point of TiSi_2 , CrSi_2
- PVD target for semiconductor (High Purity MoSi_2 , TaSi_2 , and WSi_2)
- High Temperature Thermoelectric material (FeSi_2)

LTS Research Laboratories, Inc is the largest manufacturer of Cerium Silicide (CeSi_2) powder and granules. Cerium silicide is used as a surrogate material to investigate the feasibility of high-energy ball milling and Spark Plasma Sintering (SPS) for the production of uranium silicide.

Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

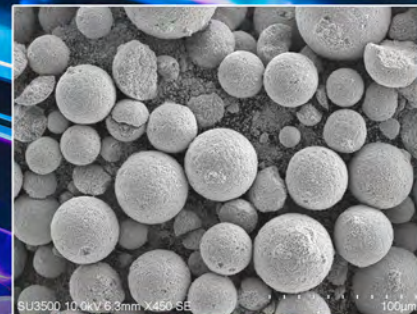
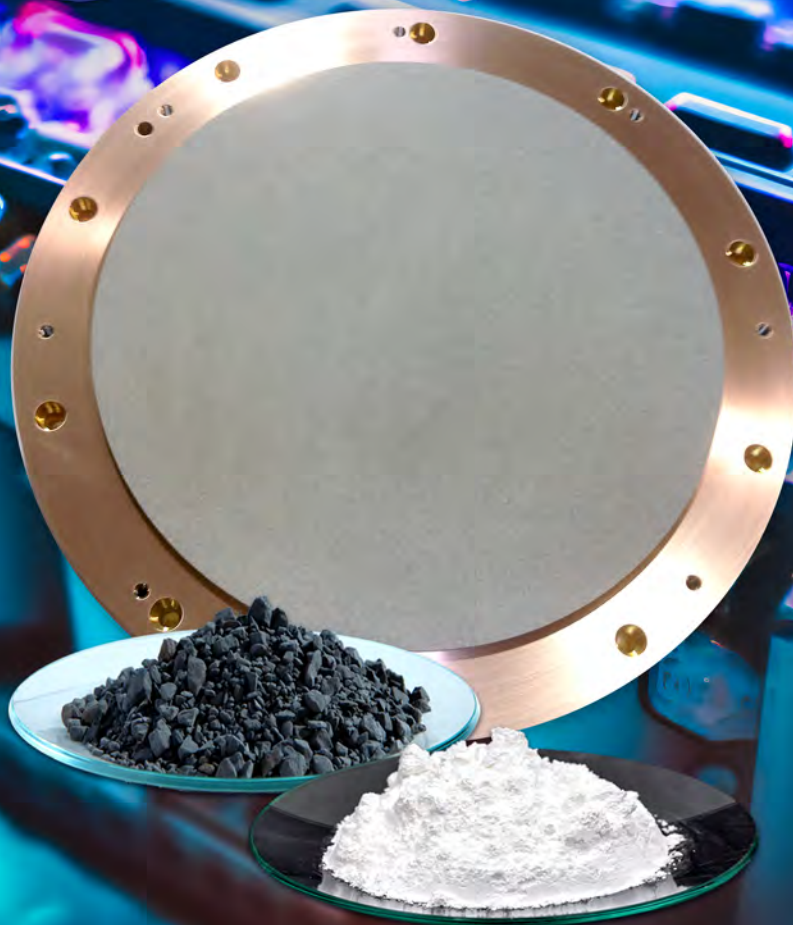
☎ +1 (845) 293 0587
📞 (845) 818 3593
✉ info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.



CHEMICAL NAME	FORMULA	CAS #
Calcium Silicide	CaSi ₂	12013-56-8
Cerium Silicide	CeSi ₂	12014-85-6
Cobalt Silicide	CoSi ₂	12017-12-8
Chromium Silicide	Cr ₃ Si ₂	12134-19-9
Chromium Silicide	CrSi ₂	12018-09-6
Erbium Silicide	ErSi ₂	12434-16-1
Europium Silicide	EuSi ₂	12434-24-1
Iron Silicide	FeSi ₂	12022-99-0
Gadolinium Silicide	GdSi ₂	12134-75-7
Hafnium Silicide	HfSi ₂	12401-56-8
Lanthanum Silicide	LaSi ₂	12056-90-5
Lithium Silicide	LiSi ₂	
Molybdenum Silicide	MoSi ₂	12136-78-6
Niobium Silicide	NbSi ₂	12034-80-9
Neodymium Silicide	NdSi ₂	12137-04-1
Praseodymium Silicide	PrSi ₂	12066-83-0
Ruthenium Silicide	Ru ₃ Si ₂	
Tantalum Silicide	TaSi ₂	12039-79-1
Titanium Silicide	TiSi ₂	12039-83-7
Vanadium Silicide	VSi ₂	12039-87-1
Tungsten Silicide	WSi ₂	12039-88-2
Ytterbium Silicide	YbSi ₂	12039-89-3
Yttrium Silicide	YSi ₂	12067-55-9
Zirconium Silicide	ZrSi ₂	12039-90-6
Cobalt Silicon Boron	CoSiB	
Chromium (III) Silicide	Cr ₃ Si	12018-36-9
Iron Silicide	FeSi	12022-95-6

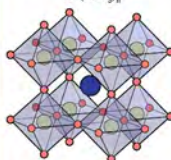
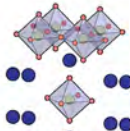
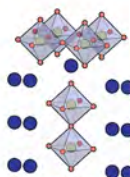
PEROVSKITES



Perovskite oxides with excellent physicochemical properties (electronic & solid-state phenomena) have established its wide application in capacitors, sensors, electrochromic & electromechanical devices, field effect transistor, memory devices, solid oxide fuel cells, and energy storage & conversion devices.

LTS Research Laboratories, Inc produces ultra-high purity perovskite inorganic oxide powders, pieces, cylinders, sputtering targets, and custom products.

PEROVSKITES

 Ruddlesden-Popper Phases
 $AO(ABO_3)_n$

 $n=2$
 $(AO)(ABO_3)_2$

 $n=1$
 $(AO)(ABO_3)$

 $n=2$
 $(AO)(ABO_3)_2$

Product	Formula	Product	Formula	Product	Formula
Barium Titanate	$BaTiO_3$	Potassium Metavanadate	KVO_3	Aluminum Titanate	Al_2TiO_5
Sodium Titanate	$Na_2Ti_3O_7$	Lithium Vanadate	$LiVO_3$	Lithium Manganese Dioxide	$LiMnO_2$
Lithium Iron Phosphate	$LiFePO_4$	Ammonium Metavanadate	NH_4VO_3	Lithium Nickel Oxide	$LiNiO_2$
Lithium Cobalt dioxide	$LiCoO$	Lead Vanadate	$PbO \cdot V_2O_5$	Lithium Titanium Oxide	$Li_4Ti_5O_{12}$
Lithium Tantalate	$LiTaO_3$	Rubidium Vanadate	$RbVO_3$	Lanthanum calcium Manganate	LCMO
Lithium Titanate	Li_2TiO_3	Lutetium Vanadate	$LuVO_4$	Lanthanum Iron Oxide	$LaFeO_3$
Barium Vanadium Oxide	$BaVO_3$	Strontium Vanadate	$Sr_2V_2O_7$	Potassium niobate	$KNbO_3$
Barium Strontium Titanate	$BaSrTiO_3$	Yttrium Titanium Oxide	$Y_2Ti_2O_7$	Lithium Niobate	$LiNbO_3$
Barium Zirconium Titanate	$BaTiZrO_5$	Lead Zirconate titanate	PZT	Bismuth ferrite	$BiFeO_3$
Calcium Copper Titanate	$CaCu_3Ti_4O_{12}$	Calcium Titanate	$CaTiO_3$	Barium Ferrite	$BaFe_{12}O_{19}$
Zinc Titanium Oxide	$ZnTiO_3$	Cesium Titanate	Cs_2TiO_3	Calcium Ferrite	$CaFe_2O_4$
Sodium Vanadate	$NaVO_3$	Copper Titanate	$CuTiO_3$	Manganese Iron Oxide	$MnFe_2O_4$
Yttrium Vanadate	YVO_4	Iron Titanate	Fe_2TiO_5	Strontium Ferrite	$SrFe_{12}O_{19}$
Silver Metavanadate	$AgVO_3$	Gadolinium Titanate	$Gd_2Ti_2O_7$	Yttrium Ferrite (YIG)	$Y_2Fe_5O_{12}$
Bismuth Vanadate	$BiVO_4$	Hafnium Titanate	$HfTiO_4$	Lanthanum Titanate	Li_2TiO_3
Cesium Metavanadate	$CsVO_3$	Lanthanum Titanium Oxide	$La_2Ti_2O_7$	Lanthanum Strontium Ferrite	$La_{0.8}Sr_{0.2}FeO_3$
				Neodymium Ferrite	$NdFeO_3$



Corporate Office
 37 Ramland Road
 Orangeburg, NY 10962

R&D / Distribution center
 2001 Oaks Parkway
 Belmont, NC 28012

+1 (845) 293 0587
 (845) 818 3593
info@ltschem.com

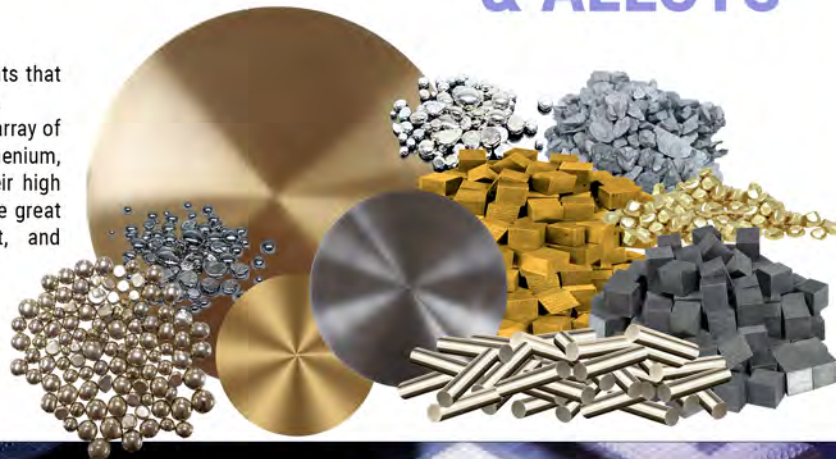


www.ltschem.com

PRECIOUS METAL & ALLOYS

Precious metals & alloys are chemically inert & rare elements that exhibit exceptional properties, mainly based on their composition.

LTS Research Laboratories, Inc. is versatile in producing an array of high-purity precious metal alloys containing platinum, silver, ruthenium, gold, palladium, etc., prized in the industry as coatings for their high chemical resistance & electrical conductivity having considerable great attention in electronics, aerospace and defense, catalyst, and photovoltaics.



Electronics Industry

Jewelry

Dentistry

Investment and Store of Value

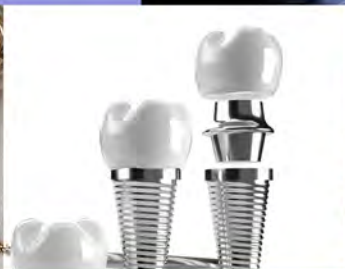
Aerospace and Defense

Catalysts

Medical and Healthcare

Photovoltaics

Chemical and Laboratory Equipment



PRECIOUS METAL & ALLOYS

LTS strives to produce state-of-the-art materials matched to your specifications. For instance, our research & development has produced high-purity malleable metal alloys namely,

- Gold Germanium (AuGe), Gold Palladium (AuPd), & Gold Tin (AuSn) using vacuum induction melting or e-beam melting in various compositions for R&D and commercial applications.
- Platinum-Iridium (90% platinum) alloys Corrosion, corrosion-resistant applications, and high-temperature stability, and Platinum-Rhodium (95% platinum) alloy is used in hardness electrical contacts using high-temperature metallurgy.
- Eutectic alloy formation of Gold-germanium alloys under 30% germanium (with eutectic composition 90/10 wt%, 95/5 wt%, 88/12 wt% of gold/germanium, respectively) has the lowest melting point than gold, serves as better candidate for low-temperature bonding and soldering in semiconductor devices and high-performance optoelectronic thermal detectors.
- Cobalt-Chromium-Platinum alloys have been produced through metal injection molding (MIM) having considerable attention in magneto-optical and magnetic recording applications.

Chemical Name	Formula	Chemical Name	Formula
Gold Shots (1-3 mm)	Au	Iridium Ingot (14.8 mm dia x 12.9 mm long)	Ir
Gold Tin (80/20 at%)	Au:Sn	Iridium Manganese (22/78 wt%) Target 2" dia x 0.25" th.	Ir:Mn
Gold Germanium (88/12 wt%),(95/5 wt%),(90/10 wt%)	Au:Ge	Iridium Manganese Granules (22/78 wt%)	Ir:Mn
Gold Palladium Target (60/40 wt%)	Au:Pd	Nickel Palladium Target (21.4 mm dia x 10.73 mm th.)	Ni:Pd
Gold Targets (3" dia x 3 mm th.)	Au	Iron Rhodium Target (50/50 at%)	Fe:Rh
Gold Zinc Granules (88/12 wt%)	Au:Zn	Chromium Ruthenium Target (2" dia x 0.125" th.)	Cr:Ru
Gold Silver Shots (35/65 at%)	Au:Ag	Nickel Platinum Target (90/10 at%), (95/5 wt%)	Ni:Pt
Silver Pellets (3 mm dia x 3 mm th.)	Ag	Iron Platinum Target (50/50 at%)	Fe:Pt
Silver Nickel Target (1" dia x 6 mm th.)	Ag:Ni		

We offer our high purity precious metal and alloys in several forms, including sputtering targets, granules, pellets, pieces, shots, and custom forms. For more information on our products and services, please visit our website at www.ltschem.com or post your queries at sales@ltschem.com

Corporate Office
 37 Ramland Road
 Orangeburg, NY 10962

R&D / Distribution center
 2001 Oaks Parkway
 Belmont, NC 28012

+1 (845) 293 0587
 (845) 818 3593
info@ltschem.com





RARE EARTH METALS AND ALLOYS

GADOLINIUM



WE WELCOME ANY REQUEST FOR MATERIALS NOT INCLUDED IN THIS LIST

www.ltschem.com



Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587
☎ (845) 818 3593
✉ info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.

RARE EARTH METALS AND ALLOYS

RARE EARTH METALS AND ALLOYS

GADOLINIUM



Gadolinium is the most abundant element among rare-earth metals having a massive impact due to its high magnetic moment owing to the seven unpaired electrons.

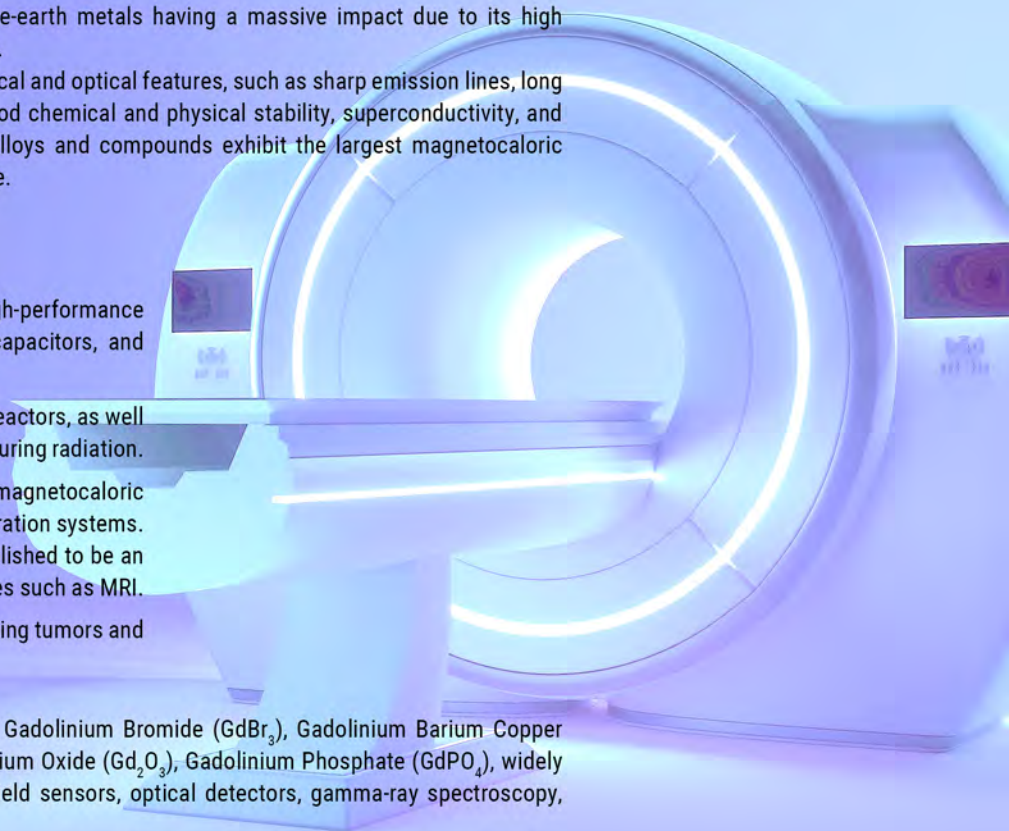
Mainly, Gadolinium sesquioxide has phenomenal chemical and optical features, such as sharp emission lines, long lifetimes, superior photostability, large Stokes shifts, good chemical and physical stability, superconductivity, and low toxicity. Gadolinium is a ferromagnetic metal; its alloys and compounds exhibit the largest magnetocaloric effects with Curie temperature close to room temperature.

Applications

- Gadolinium is used in the manufacture of high-performance electronic components, such as superconductors, capacitors, and magneto-optic data storage devices.
- Gadolinium is used as a neutron absorber in nuclear reactors, as well as in gamma-ray spectroscopy for detecting and measuring radiation.
- Gadolinium alloys and compounds exhibit the largest magnetocaloric effects, making them ideal for use in magnetic refrigeration systems. In the healthcare industry, gadolinium has been established to be an efficient contrast agent for medical imaging techniques such as MRI.
- Gadolinium is also used in nuclear medicine for detecting tumors and abnormal tissue growth.

LTS also offers other Gd specialty chemicals namely, Gadolinium Bromide (GdBr_3), Gadolinium Barium Copper Oxide ($\text{GdBa}_2\text{Cu}_3\text{O}_7$), Gadolinium Fluoride (GdF_3), Gadolinium Oxide (Gd_2O_3), Gadolinium Phosphate (GdPO_4), widely used for high-temperature superconductors, magnetic field sensors, optical detectors, gamma-ray spectroscopy, nuclear and high energy physics research.

Our team of experts is committed to providing exceptional quality products and services to our customers, and we pride ourselves on our reputation as a trusted producer of high-purity gadolinium products.





YTTERBIUM RARE EARTH METALS AND ALLOYS

www.ltschem.com



Powders
40, 60, 100 mesh



Pellets



Granules



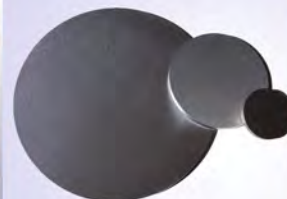
Shots/Cubes



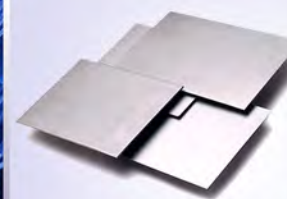
Inserts



Rods



Targets



Foil

WE WELCOME ANY REQUEST FOR MATERIALS NOT INCLUDED IN THIS LIST



Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587
☎ (845) 818 3593
✉ info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.

RARE EARTH METALS AND ALLOYS

YTTERBIUM Metal

RARE EARTH METALS AND ALLOYS

Ytterbium (Yb) is a rare-earth, divalent metal that is malleable, silvery, and reactive. When exposed to air, it oxidizes to form a C-type sesquioxide structure called Ytterbium oxide (Yb_2O_3).

Yb exists in three allotropes: alpha, beta, and gamma phases. The beta phase exhibits metallic-like electrical conductivity but becomes a semiconductor when exposed to 16000 atm (1.6 GPa). Unlike other rare-earth metals, Ytterbium behaves as a paramagnetic material at low temperatures above 1.0 kelvin, and the alpha phase of Yb remains diamagnetic. Ytterbium (III) ion absorbs light in the near-infrared region, making it a potential candidate for use in non-linear optical devices and other technological applications.

LTS manufactures sputtering targets, alloys, thermal spray coating chemicals, specialty chemicals, and custom-made synthetic chemicals. Ytterbium carbide (YBC) DFM grade is a highly preferred low index material, transparent from the UV to IR region of the spectrum. Especially, our high purity specialty materials YBC-375, YBC-905, and YBC-907 are replacements for the radioactive ThF_4 in infrared applications. Many CO_2 laser producers in the USA have completely switched to using the non-radioactive YBC-375, YBC-905, and YBC-907, which are established as the best materials for CO_2 lasers.

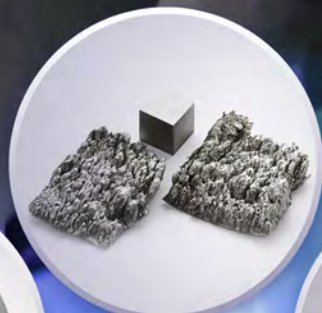
Applications

- Ytterbium can also be used as a dopant in stainless steel to help refine grain refinement, strength, and other mechanical properties.
- Ytterbium (Yb^{3+}) is a doping agent in high-power and wavelength-tunable solid-state lasers, semiconductors, metal alloys, and in portable x-ray devices.
- Specific ytterbium isotopes generate gamma rays used to create a radiographic image of an object without the use of electricity.
- Yb_2O_3 extended its contribution of use in optical fibers, optical materials, catalysis, solid oxide fuel cells, and non-linear optics.

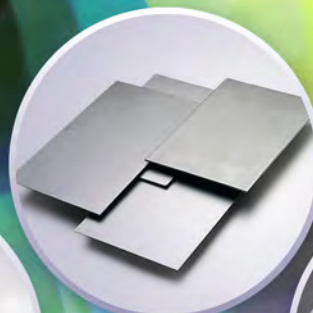


SCANDIUM PRODUCTS

WE WELCOME ANY REQUEST FOR MATERIALS NOT INCLUDED IN THIS LIST



**Scandium
Metal Dendritic**



**Scandium
Metal Foil**



**Scandium
Oxide Target**



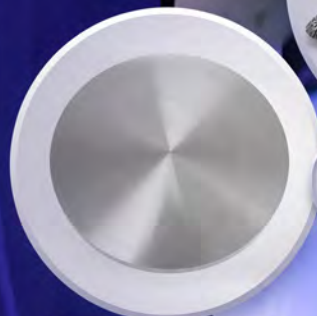
**Starter
source (Insert)**



**Scandium
Metal Powder**



**Scandium
Oxide Pieces**



**Scandium
Metal Target**

SCANDIUM PRODUCTS



SCANDIUM PRODUCTS

Scandium (III) oxide or scandia is an inorganic compound with the formula Sc_2O_3 , used in the preparation of other scandium compounds as well as in high-temperature systems (for its resistance to heat and thermal shock), electronic ceramics, and glass composition. It is one of several oxides of rare earth elements with a high refractive index with durable layers in thin film coating at around 300 nm.

Other Scandium products

- Scandium Chloride (ScCl_3) powder
- Scandium Fluoride (ScF_3) powder
- Scandium Acetate ($\text{C}_6\text{H}_9\text{O}_6\text{Sc}$) powder
- Scandium Nitrate Hydrate ($\text{Sc}(\text{NO}_3)_3 \cdot x\text{H}_2\text{O}$)

- $\text{ScF}_3 \cdot \text{LiF}$ Solid solution

- Mg-Sc alloy
- Al-Sc alloy

Applications

A high melting white solid is used in high-temperature systems (for its resistance to heat and thermal shock), electronic ceramics, and glass composition. Suitable for vacuum deposition applications. Also used to make scandium fluoride.

Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587
📞 (845) 818 3593
✉ info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.



www.ltschem.com



SEMICONDUCTING CHALCOGENIDE GLASSES

Semiconducting chalcogenide glasses, first produced in the late 1950's, are classified as covalently bonded network solids that act as a single molecular complex.

They exhibit a variety of unique thermal, optical, and electrical properties, most notably for the ability to undergo high speed phase transitions.

With ultrafast broadband response times, tunable third order nonlinear refractive indices, and specific optical band gap energies, Chalcogenide glasses are promising candidates for modern technological applications such as IR detectors, lenses, optical fibers, and photonic integrated circuits, as well as emergent Phase-change Random Access Memory (PCRAM).

In PCRAM applications, the glass is subjected to localized electric current pulses which trigger the thermally driven phase transformations from an amorphous to crystalline state; this process is reversed by a brief exposure to heat followed by rapid quenching. A readout is performed utilizing the differences in conductivity between the two phases. Cycles take only nanoseconds in application.



- » Germanium Antimony Telluride (GST)
- » Selenium Arsenic Germanium (SAG)

- » Germanium Arsenic Selenium Telluride (GAST)
- » Tellurium Arsenic Germanium Silicon (TAGS)

The following materials are currently made in 125 mm and up to 440 mm diameter sizes for ULVAC, VEECO, and Anelva systems. Custom compositions and the addition of dopants are being developed to enhance thermal and electrical properties



SEMICONDUCTOR-GRADE MATERIALS

LTS manufactures an entire series of Sulfides, Arsenides, Selenides, Germanides, and other intermetallics for MEMS and semiconductor applications, integrated circuit, and flat panel display technologies.

LTS employs an array of vacuum furnaces from 300-500 L for the purification and custom alloying of semiconductor compounds in the form of evaporation pieces and sputtering targets.

TELLURIDES		SELENIDES		SULFIDES	
Antimony Telluride	Sb_2Te_3 ; Sb_2Te_2	Antimony Selenide	Sb_2Se_3	Antimony Sulfide	Sb_2S_3
Arsenic Telluride	As_2Te_3	Arsenic Selenide	AsSe ; As_2Se_3	Arsenic Sulfide	As_2S_3
Bismuth Telluride	Bi_2Te_3	Aluminum Selenide	Al_2Se_3	Bismuth Sulfide	Bi_2S_3
Copper Telluride	CuTe ; CuTe_2	Bismuth Selenide	Bi_2Se_3	Chromium Sulfide	Cr_2S_3
Gallium Telluride	GaTe ; Ga_2Te_3	Copper Germanium Selenide	CuGeSe	Copper Antimony Sulfide	CuSbS
Germanium Telluride	GeTe ; GeTe_2	Copper Indium Gallium Selenide	CIGS	Copper Germanium Sulfide	Cu_2GeS_3
Mercury Telluride	HgTe	Copper Gallium Selenide	CuGaSe_2	Copper Sulfide	Cu_2S
Tungsten Telluride	WTe_2	Indium Selenide	In_2Se_3	Copper Zinc Tin Sulfide	$\text{Cu}_2\text{InSnS}_4$
		Lead Selenide	PbSe	Germanium Sulfide	GeS
		Tin Selenide	SnSe ; SnSe_2	Silver Sulfide	Ag_2S
		Iron Selenide	FeSe		
		Hafnium Selenide	HfSe_2		
		Lithium Selenide	Li_2Se		
		Molybdenum Selenide	MoSe_2		
		Niobium Selenide	NbSe_2		
		Tantalum Selenide	TaSe_2		
		Tungsten Selenide	WSe_2		
ARSENIDES				GERMANIDES	
Gallium Arsenide	GaAs			Copper Germanium	CuGe
Gallium Arsenide Titanium	GaAsTi			Germanium Antimony	GeSb
Indium Arsenide	InAs			Germanium Tin	GeSn
Tin Arsenide	SnAs			Gold Germanium	AuGe
Zinc Arsenide	ZnAs_2 ; Zn_3As_2			Silicon Germanium	SiGe



Corporate Office
 37 Ramland Road
 Orangeburg, NY 10962

R&D / Distribution center
 2001 Oaks Parkway
 Belmont, NC 28012

+1 (845) 293 0587
 (845) 818 3593
 info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.



www.ltschem.com



STARTER SOURCES

LTS Research Laboratories, Inc. is a leader in manufacturing high-purity optical coating materials. LTS produces the starter source material by **pressure-sintering** or **E-beam melting** or **vacuum-melting**. Our starter sources are ready for the deposition process. We supply high-quality products to optics, fiber optics, electronics, automotive, aerospace, crystal growth, and fuel cell industries.

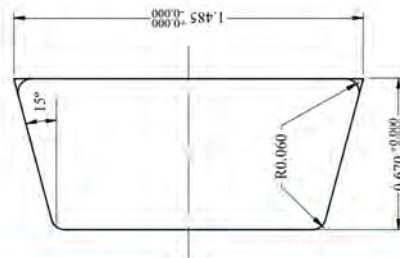
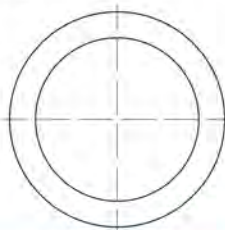
Among others, **LTS** is recognized worldwide for its new class of fluoride materials produced via DFM®. This novel production method allows us to surpass material quality achieved by conventional means completely.





STARTER SOURCES

LTS manufactures superior-quality E-beam deposition cones and starter sources for the thin film industry. A range of sizes are offered in metal, oxide, suboxide, and fluoride forms. Although standard sizes are **2.2 cc, 7 cc, 13 cc, 15 cc, 20 cc, 25 cc, 40 cc and 60 cc**, we offer custom sizing and crucible design. Pre-melted suboxides of the following materials are also available.



METAL		OXIDES		FLUORIDES	
Aluminum	Al	Aluminum Oxide	Al ₂ O ₃	Gadolinium Fluoride	GdF
Chromium	Cr	Hafnium Oxide	HfO ₂	Magnesium Fluoride	MgF
Gold	Au	Indium Oxide	In ₂ O ₃	Ytterbium Fluoride	YbF
Magnesium	Mg	Molybdenum Oxide	MoO ₃	ALLOYS	
Nickel	Ni	Scandium Oxide	Sc ₂ O ₃		
Niobium	Nb	Silicon Oxide	SiO ₂		
Palladium	Pd	Tantalum Oxide	Ta ₂ O ₅		
Platinum	Pt	Titanium Oxide	TiO ₂		
Scandium	Sc	Tungsten Suboxide	WO _x	Cobalt Chromium	Co/Cr
Tantalum	Ta	Zirconium Oxide	ZrO ₂	Gold Germanium	Au/Ge
Titanium	Ti			Gold Nickel	Au/Ni
Hafnium	Hf			Nickel Palladium	Ni/Pd
Vanadium	V			Nickel Vanadium	Ni/V





TANTALUM METAL



ROD
WIRE

PELLETS
PIECES

CONICAL INSERT
RING

FOIL

IBS
TARGETS

CUSTOM OVAL
TARGET

DELTA SPUTTERING
TARGET

CUSTOM
SPUTTERING
TARGET

POWDERS

TANTALUM METAL PRODUCTS



TANTALUM METAL

Tantalum (Ta) offers distinctively valuable properties concerning some of the other refractory metals such as extremely high melting point (2996 °C), malleability, a highly stable metal that is almost immune to chemical degradation at temperatures lower than 302° F (159° C), outstanding ability to promote bone regeneration, biocompatibility, chemical and thermal resistance. Because of its unique features, it is consistently used in the electronics, medical, aerospace, military, and nuclear energy industries.

APPLICATIONS

- High-temperature applications such as aircraft engine
- Electrical devices such as capacitors in computers and mobile phones
- Surgical implants such as artificial joints and cranial plates, and surgical sutures
- In chemical industries, it is used as heat exchangers in boilers in which strong acids are vaporized
- As a substitute material for expensive platinum
- As components for nuclear power plants and missiles
- Raw material in the production of military hardware and electromagnetic components

LTS manufactures high-purity Tantalum conical inserts, crucible liners, cylinders, foils, pellets, pieces, powders, rings, wires, rods, sputtering targets (delta type), and custom-made products. Our team of experts is committed to providing exceptional quality products and services to our customers, and we pride ourselves on our reputation as a trusted producer of high-purity Tantalum metal products.

Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587
📠 (845) 818 3593
✉ info@ltschem.com



TANTALUM

PENTOXIDE



POWDERS



GRANULES

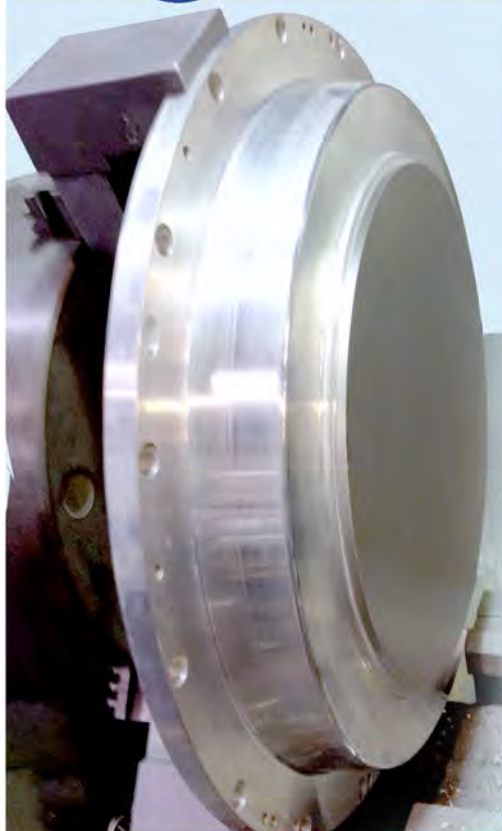


GRANULES



PELLETS

TANTALUM PENTOXIDE



The digital age and the increasing demand for electronic and semiconductor products have paved the way for the development of ultra-pure optical coatings. Tantalum pentoxide (Ta_2O_5) is a material with exceptional physical and chemical properties, such as high dielectric, high refractive index, wide bandgap ($E_g = 4\text{eV}$), and superior photoelectric performance, making it a suitable choice for various applications in optical communications, microelectronics, aerospace and defense, and medical devices. As a semiconductor material, it offers structural stability, cost-effectiveness, eco-friendliness, and relatively high efficiency, making it an ideal choice for optical coatings, ceramics, and microelectronic devices.

APPLICATIONS

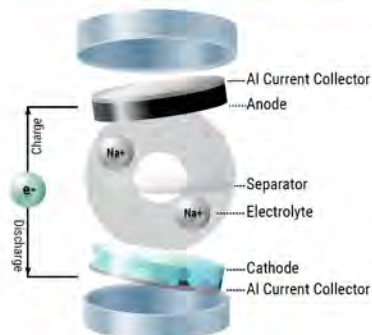
- Near-UV (350 nm) to IR ($> 8 \mu\text{m}$) antireflection and multilayer filter coatings
- Highly durable, hard, and scratch-resistant coatings
- Telecommunication applications in operating Nd-doped YAG lasers
- Low absorption in the near-IR region
- Dielectrics in film capacitors with low leakage current
- Gate insulators in large-scale integrated circuits
- Ion conductor Electrochromic devices
- Semiconductor industry applications in dynamic RAM access memory fabrication
- High X-ray attenuation coefficient and biocompatibility

LTS is a trusted producer of high-purity Tantalum pentoxide pellets, pieces, powders, sputtering targets, and custom-made products. Our team of experts is committed to providing exceptional quality products and services to our customers, and we take pride in our reputation as a reliable supplier of high-grade Tantalum pentoxide products. All our products come with a certificate of analysis that includes structural, optical, and morphological data to ensure that each material meets the product specification. For more information on our products and services, please visit our website at ltschem.com and use our Product Search tool.

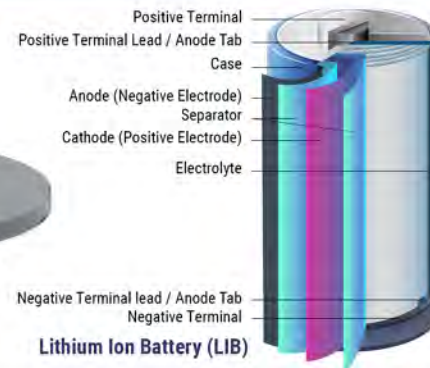
Corporate Office
 📍 37 Ramland Road
 Orangeburg, NY 10962

R&D / Distribution center
 📍 2001 Oaks Parkway
 Belmont, NC 28012

☎ +1 (845) 293 0587
 📞 (845) 818 3593
 ✉ info@ltschem.com



Sodium Ion battery (SIB)



Lithium Ion Battery (LIB)

Advancements in technology made us utilize batteries in electric vehicles and all portable electronic devices. Rechargeable batteries are widely used in various applications, including consumer electronics, electric vehicles (EVs), and energy storage systems. They have gained significant attention and become the preferred choice due to their high energy density, long cycle life, and relatively low self-discharge rate.

LTS Research Laboratories, Inc. supply a large selection of anodes, cathodes, and solid-state electrolyte for energy storage devices in powder, granules, disc, foils, targets, and custom forms. Above are our most requested lines for cathodes and anodes, however, we welcome an inquiry for other specifications.

WHEN EVALUATING BATTERY MATERIALS, THE FACTORS OF IMPORTANCE ARE AS FOLLOWS



ENERGY DENSITY
The amount of energy stored per unit weight or sometimes per volume



SPECIFIC POWER
The speed you can deliver that energy



LIFESPAN
How many charge-discharge cycles can the battery sustain before chemical changes render it too weak to function.



COST
Self explanatory



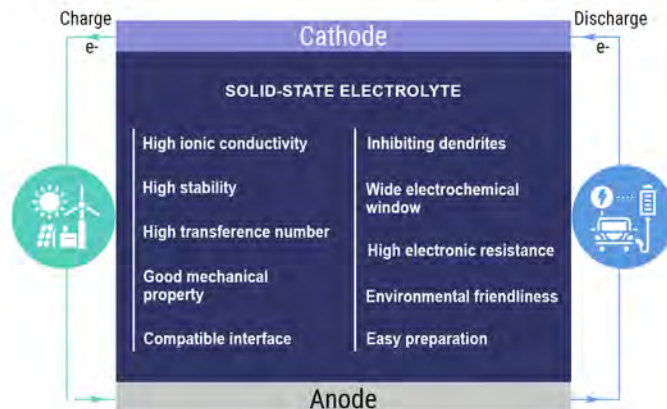
SAFETY
We should also consider Safety since lithium has a tendency to cause fires



DURABILITY
Against high and low temperatures and idle time



RECHARGE RATE
Unit battery experts use to measure the speed at which a battery is fully charged or discharged



LTS Research Laboratories, Inc. produces all types of oxides, sulfides, halides-based electrodes (cathode & anode), and next-generation solid-state electrolytes for high-performance energy storage devices (Batteries & Supercapacitors). All our products are supplied with a certificate of analysis that includes structural, optical, and morphological data to ensure that each material fulfills product specifications. Please see our below list for our common lines but we welcome the opportunity to collaborate on custom R&D projects.

Materials For Lithium/Sodium - Ion Batteries

CATHODES	ELECTROLYTES
Lithium Iron Phosphate (Li_xPO_4) (LIPON)	Lithium Tin Phosphorous Sulfide ($\text{Li}_{10}\text{SnP}_2\text{S}_{12}$)
Lithium Cobalt Oxide (LiCoO_2)	Lithium Phosphorus Sulfide (Li_3PS_4)
Lithium Manganese Oxide (LiMn_2O_4)	Lithium Germanium Phosphorus Sulfide (LiGePS)
Lithium Nickel Cobalt Aluminum Oxide ($\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$)	Lithium Germanium Phosphorus Sulfur Chloride ($\text{Li}_{10}\text{GeP}_2\text{S}_{12}\text{Cl}$)
Lithium Manganese Nickel Oxide ($\text{LiMn}_{1.5}\text{Ni}_{0.5}\text{O}_4$)	Lithium Phosphorus Sulfur Bromide ($\text{Li}_6\text{S}_2\text{Br}$)
Lithium (Li) Foil, Disc	Lithium Phosphorus Sulfur Chloride ($\text{Li}_3\text{PS}_3\text{Cl}$)
Sulfur Powder (S)	Lithium Phosphorus Sulfur Iodide ($\text{Li}_6\text{PS}_4\text{I}$)
Sodium Vanadium Phosphate ($\text{Na}_3\text{V}_2(\text{PO}_4)_3$)	Lithium Phosphorus Tellurium Bromide ($\text{Li}_4\text{PTe}_3\text{Br}$)
NASICON ($\text{Na}_3\text{Fe}_2(\text{SO}_4)_3$)	Lithium Phosphorus Tellurium Chloride ($\text{Li}_4\text{PTe}_3\text{Cl}$)
Sodium Iron Phosphate (NaFePO_4)	Lithium Phosphorus Tellurium Iodide ($\text{Li}_4\text{PTe}_3\text{I}$)
Sodium Nickel Phosphate (NaNiPO_4)	Aluminum doped Lithium Lanthanum Zirconium Oxide ($\text{Li}_{7-3x}\text{Al}_x\text{La}_{0.5}\text{Zr}_{2.5}\text{O}_{12}$)
Sodium Chromium Oxide (NaCrO_2)	Lithium Lanthanum Tantalum Oxide ($\text{Li}_7\text{La}_2\text{Zr}_{2.5}\text{Ta}_{0.5}\text{O}_{12}$)
	Lithium Lanthanum Titanium Oxide (LiLaTiO_3)
	Lithium Aluminum Germanium Phosphate ($\text{LiAlGeP}_3\text{O}_{12}$)
	Lithium Silicate (Li_2SiO_3)
	Lithium Phosphate (Li_3PO_4)
	Germanium Sulfide (GeS_2)
	Lithium Sulfide (LiS_2)
	Lithium Nitride (Li_3N)
	Sodium Thioantimonate (Na_3SbS_3)
	Sodium Hexafluorophosphate (NaPF_6)
	Sodium Manganese Phosphate (NaMnPO_4)
	Sodium Manganese Oxide ($\text{Na}_{0.44}\text{MnO}_2$)
ANODES	
Lithium Titanium Oxide ($\text{Li}_x\text{Ti}_5\text{O}_{12}$)	
Germanium Oxide (GeO_2)	
Natural Graphite	
Silicon Oxide (SiO_2)	
Sodium Titanate ($\text{Na}_2\text{Ti}_2\text{O}_7$)	
Sodium titanium phosphate ($\text{NaTi}_2(\text{PO}_4)_3$)	
Sodium (Na), Disc	
Tin Phosphide (Sn_3P_2)	

LTS can developed customized Cathode, Anode & Electrolytes materials including but not limited to:

- Unique compositions for Cathode, Anode and Solid electrolytes
- Materials can be customized for Lithium-Ion & Sodium-Ion batteries
- Particle size and morphology can be modified
- Production of high yield products from gram to kilogram
- Enhance or modify the existing material properties

For more information on our products and services, please visit our website at www.ltschem.com or post your queries at sales@ltschem.com

Corporate Office
 37 Ramland Road
 Orangeburg, NY 10962

R&D / Distribution center
 2001 Oaks Parkway
 Belmont, NC 28012

+1 (845) 293 0587
 (845) 818 3593
info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.



CHROMIUM

www.ltschem.com



Applications



IN METAL CERAMICS



TO MANUFACTURE MOLDS FOR THE FIRING OF BRICKS



IN CHROME PLATING



AS A CATALYST IN DYEING AND TANNING OF LEATHER



AS DYES AND PAINTS



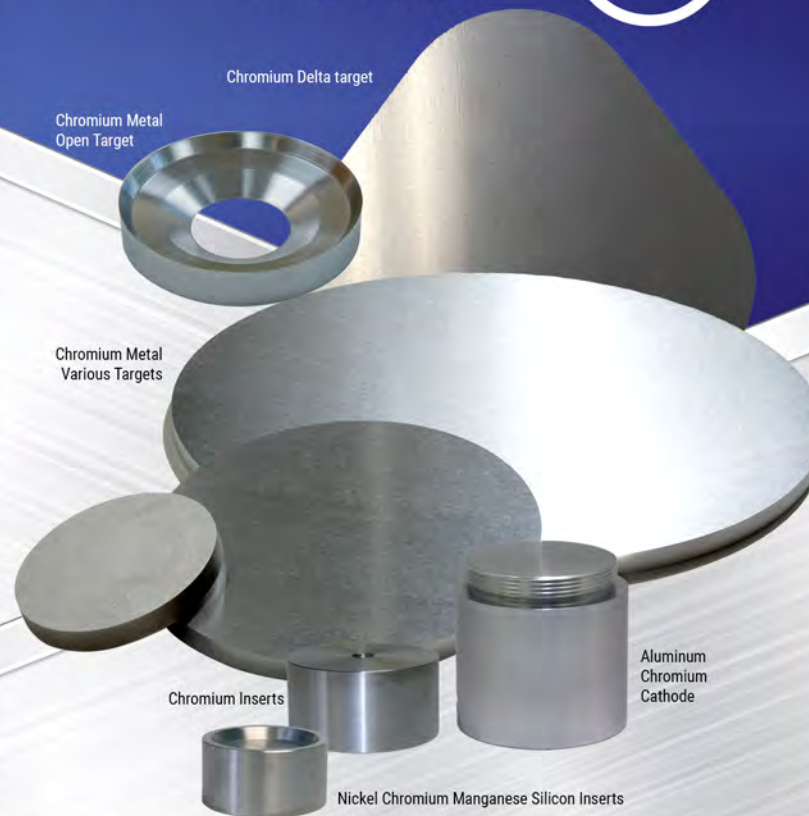
IN METALLURGY TO PROVIDE CORROSION RESISTANCE AND A SHINY FINISH



TO PRODUCE SYNTHETIC RUBIES



IN ALLOYS



Chromium Delta target

Chromium Metal Open Target

Chromium Metal Various Targets

Chromium Inserts

Aluminum Chromium Cathode

Nickel Chromium Manganese Silicon Inserts

CHROMIUM



Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

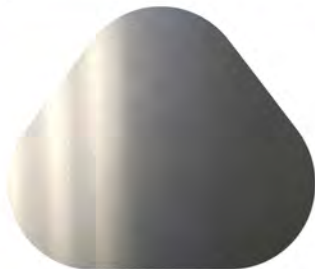
R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587
☎ (845) 818 3593
✉ info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.

LTS produce high-purity Chromium compounds such as metal targets (CrSiO, Cr, S-Gun, delta etc.), pellets, powders, melted pieces, inserts, AlCr cathode

DELTA TARGET



CrSi₂, Cr₂O₃, CrSiO AND OTHER TARGETS



VARIOUS SIZES Cr METAL TARGETS



S-Gun TARGET



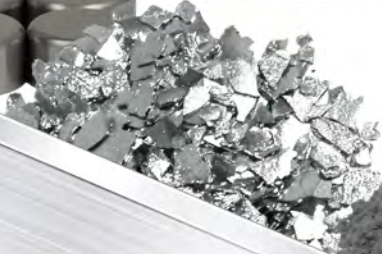
AlCr CATHODE



CHROMIUM INSERTS



ELECTRILYIC PIECES



POWDER

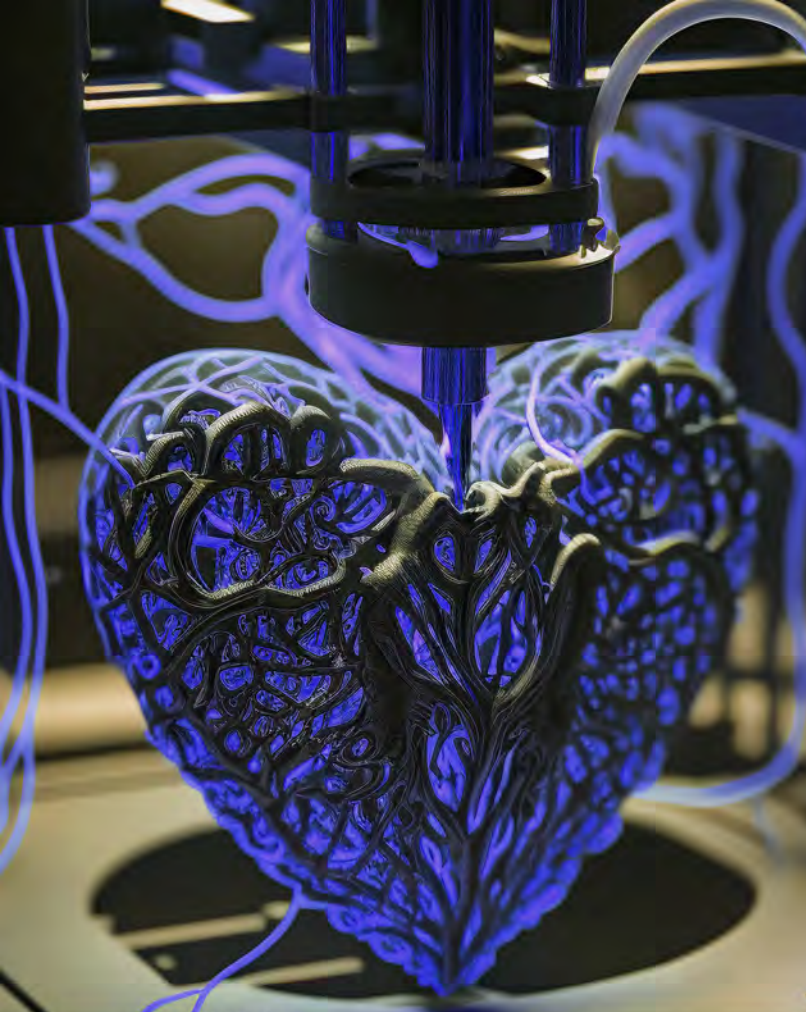


CHROMIUM MELTED PIECES

CHROMIUM PELLETS



Chromium is used in paints wood preservatives, dyes stains, curing compounds rust inhibitors and mainly in the production of stainless steel and in chrome plating. Being hardest material with corrosion resistance, high-temperature and tensile strength makes Chromium to be a suitable candidate for oil, gas, energy, construction and the automotive industries



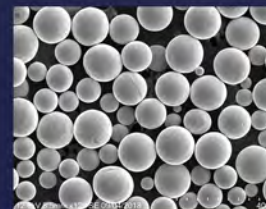
3D PRINTING

www.ltschem.com



LTS Research Laboratories, Inc. is a leading manufacturer of precision-engineered powders for advanced manufacturing processes. Our extensive range of spherical metals, alloys, ceramics, and composites powders are specifically designed to meet a variety of applications including,

3D printing
powder metallurgy
advanced ceramics production
metal induction molding (MIM)
high surface area catalysis
thermal spray, energy storage
high-surface area sorbent applications



Using gas/water atomization, plasma spheroidization, thermal spraying, and air classification, our powders are specifically produced for 3D printing applications, providing outstanding flowability, layer uniformity, and sinterability. With our powders, you can create precise and durable, complex geometries with ease, making them ideal for aerospace, automotive, electronics, medical, and other high-tech industries.

LTS offers all types of 3D printing materials and only a few have been listed in the table for your reference. All our products are supplied with a certificate of analysis that includes structural & compositional data to ensure that each material accomplishes product specifications. For more information about our product, please visit www.ltschem.com



Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587
📞 (845) 818 3593
✉ info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.

3D PRINTING

3D PRINTING MATERIAL LIST

NAME	FORMULA	CAS#	TYPICAL SIZE	NAME	FORMULA	CAS#	TYPICAL SIZE
Silver	Ag	7440-22-4	-325 mesh	Nickel	Ni	7440-02-0	-100+325 mesh, -1250 mesh, -625 mesh
Aluminum	Al	7429-90-5	-100+325 mesh	Nickel Aluminide	Ni ₃ Al	12003-81-5	-100+40 mesh, 265 mesh
Aluminum Oxide	Al ₂ O ₃	1344-28-1	-100 + 325 mesh	Nickel Chromium	NiCr	11106-97-1	-100+325 mesh, -325 mesh
Aluminum Titanate	Al ₂ TiO ₅	12004-39-6	-100 mesh	Inconel Alloys	-	-	-
Aluminum Nitride	AlN, Al ₃ N	24304-00-5	-100+325 mesh	Nickel Molybdenum	NiMo	12033-21-5	-100+325 mesh, -325 mesh
Aluminum Nickel	AlNi	12003-78-0	-100 mesh	Nickel Oxide	NiO	1313-99-1	-100 mesh
Aluminum Titanium	AlTi	12003-96-2	-325+100 mesh	Silicon Nitride	Si ₃ N ₄	12033-89-5	-100+325 mesh
Gold	Au	7440-57-5	-100 mesh	Silicon Dioxide	SiO ₂	14808-60-7	-325 mesh, -1250 mesh
Cobalt	Co	7440-48-4	-100 + 325 mesh	Stainless Steel	-	-	-
Cobalt Alloys	Co(Al, Cr, Fe)			Tantalum	Ta	7440-25-7	-325 mesh
Chromium	Cr	7440-47-3	-100+325 mesh	Tantalum Nitride	TaN	12033-62-4	-100+325 mesh
Chromium Carbide	Cr ₃ C ₂	12012-35-0	-100+325 mesh	Titanium	Ti	7440-32-6	-140+325 mesh, -100 mesh
Chromium Iron	CrFe	12052-89-0	-100+325 mesh	Titanium Aluminide	Ti ₃ Al	39410-63-4	-100 mesh
Copper	Cu	7440-50-8	-625 mesh	Titanium Aluminum Alloy	Ti ₄₈ Al ₂ Cr ₂ Nb		-100+325 mesh
Copper Chromium	CuCr	11104-65-7	-100 mesh	Titanium Aluminum Vanadium	TiAl ₆ V ₄	12743-70-3	-100+325 mesh, -100 mesh
Copper Nickel	CuNi	12357-13-0	-100 mesh	Titanium Boride	TiB	12045-63-5	-100 mesh
High Entropy Alloy	(Co-Cr-Fe-Ni-Al-Y- Mn-Zr-Hf-Nb-Ta)	-	-	Titanium Carbide	TiC	12070-08-5	-200+1250 mesh
Iron	Fe	7439-89-6	-100+325 mesh, -325 mesh	Titanium Nitride	TiN	25583-20-4	-100+325 mesh
Iron Aluminide	FeAl ₃	12003-42-8	-100 mesh, -325 mesh	Ti-Braze	TiNiZrCu		-170 mesh
Iron Boride	FeB	12006-84-7	-100 mesh	Titanium dioxide	TiO ₂	1317-80-2	-100 mesh, -325 mesh
Iron Nickel	FeNi	11110-39-7	-100 mesh	Yttrium oxide	Y ₂ O ₃	1314-36-9	-230+1250 mesh, -100 mesh
Iron Silicon	FeSi	12022-95-6	-100 mesh	Yttrium Silicate	Y ₂ Si ₂ O ₇		-100+325 mesh
Hafnium	Hf	7440-58-6	-100+325 mesh	Zinc Aluminum	ZnAl		-325 mesh
Molybdenum Boride	MoB	12006-98-3	-100 mesh	Zirconium Carbide	ZrC	12070-14-3	-100+325 mesh
Molybdenum Nickel	MoNi	12033-22-6	-100 mesh	Zirconium Nitride	ZrN	25658-42-8	-100+325 mesh
Niobium	Nb	7440-03-1	-100+325 mesh	Yttria-stabilized Zirconia	ZrO ₂ -Y ₂ O ₃	64417-98-7	-325+1250 mesh, -140+325 mesh

We welcome any customized product requests that are not included in the above list!



www.ltschem.com

ZINC SULFIDE

Metal sulfides have gained significant research attention for their exceptional properties and potential applications in electronics, optics, and optoelectronics, due to their exceptional redox reversibility and suitable energy band gap.

Among these materials, **Zinc sulfide (ZnS)** stands out as one of the most critical II-VI semiconductor materials, with a tunable wide band gap of 3.7 eV and a large exciton energy of 39 meV at room temperature.

Additionally, **ZnS** is a cost-effective and eco-friendly compound with impressive mechanical properties, including exceptional fracture strength and hardness. These physical and chemical properties have made **ZnS** a fascinating area of study for various applications, including:

- » Ultraviolet-light-emitting diodes,
- » Flat-panel displays
- » Sensors and lasers,
- » Electroluminescence devices,
- » Photoluminescence material
- » Sensors (UV-light sensors, gas sensors, biosensors),
- » Photocatalysis,
- » Pigment in paints, plastics, and rubber,
- » Nano-electronics and optoelectronic devices.



Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587
📠 (845) 818 3593
✉ info@ltschem.com

© Copyright reserved by LTS Research Laboratories, Inc.

ZINC SULFIDE



www.ltschem.com

ZINC SULFIDE

ZnS Granules

ZnS Granules

ZnS Powder

ZnS Cubes



ZnS Sputtering Target

For more information on our products and services,
please visit our website at www.ltschem.com
or post your queries at sales@ltschem.com

ZINC SULFIDE



www.ltschem.com

SINGLE CRYSTAL AND SUBSTRATES

LTS provide oxide crystal substrates suitable for epitaxial growth of dielectrics, superconductors, compound semiconductors and luminescent materials. The demand for improved electronic and optoelectronic devices has fueled the development of epitaxial growth techniques for single-crystalline semiconductors.

Epitaxial growth is the process of growing crystals on a substrate. Important factors in this process include crystallinity, flatness, surface roughness, and lattice strain. We can also customize the surface orientation, dimensions, and OFF angle to meet your specifications.



SEMICONDUCTORS

- Electrical diodes: Si, Ge, SiC
- Hall effect magnetometer: InSb
- Integrated circuits: Si, GaAs
- Infrared detectors: GaSb, InAs, HgxCd1-xTe
- LEDs: GaAs, GaSb, GaP, SnxPb1-xTe, GaN, ZnTe
- Photodiodes: Si, GaAs, HgxCd1-xTe
- Photoconduction devices: Si, HgxCd1-xTe
- Radiation detectors: Si, Ge, CdTe, BGO, PbS
- Transistors: Ge, Si, GaAs crystals
- Thyristors: Si



HARD CRYSTALLINE MATERIALS AND MATERIALS FOR MECHANICAL COMPONENTS

- Abrasives and cutting tools: SiC, diamond, sapphire (Al₂O₃)
- Bearings: Al₂O₃, Si₃N₄, ruby (Al₂O₃:Cr³⁺)
- Substrates for high-T_c superconductors: SrTiO₃
- Strain gauges: Si, Ga(As, P)
- Cantilevers: Si, Si₃N₄



PYROELECTRIC MATERIALS

- Pyroelectric devices: TGS, LiTaO₃, BaSr1-xNb₂O₆ (e.g., fire/intrusion alarms, room-temperature IR sensors, and ambient energy harvesting)

MAGNETIC MATERIALS

- Microwave filters: Garnets (Y₃Fe₅O₁₂, Y₃Al₅O₁₂)
- Tape heads: Ferrites



PIEZOELECTRIC MATERIALS

- Resonant bulk-wave devices: SiO₂, LiTaO₃
- Surface-wave devices: SiO₂, LiNbO₃
- Transducers: Quartz, Rochelle salt, ADP, PZT, ADP
- Ambient energy harvesters: PZT, PMN-PT, TGS crystals



FERROELECTRIC MATERIALS

- Memory devices: PZT
- Energy harvesting



GEMS FOR JEWELRY

- Cubic zirconia (ZrO₂), diamond, ruby, sapphire (Al₂O₃), moissanite (SiC)



OPTICAL MATERIALS

- Electro-optic devices: LiNbO₃, ADP, KDP
- Laser hosts: YAG, Al₂O₃:Cr³⁺ (ruby), alexandrite, CaWO₄, Ti:Al₂O₃, GaAs, AlGaAs, InP, InSb, AlGaInP, InGaAsSb, InGaN
- Lenses, prisms, and windows: Al₂O₃ (0.15–55.0 mm), Ge (1.8–22 mm), LaF₃ (0.4–11 mm), Si (1.2–15 mm), CaF₂ (0.12–10 mm), MgF₂ (0.11–8.0 mm), AgBr (0.5–35.0 mm), AgCl (0.4–28.0 mm), LiF (0.12–7.0 mm), CsBr (0.23–45.0 mm), quartz (0.19–4.0 mm), ZnS (0.4–13.5 mm)
- Magneto-optic devices: YIG (Y₃Fe₅O₁₂)
- Nonlinear optical devices: ADP, KDP, LiNbO₃, KTP, BBO, LBO, CLBO
- Polarizers: CaCO₃, NaNO₂
- X-ray monochromators: Si, KAP
- Photorefractive devices (e.g., holographic data storage and phase-conjugate mirrors): BaTiO₃, LiNbO₃:Fe³⁺, BSO (Bi₁₂SiO₂₀)
- Scintillation detectors: NaI:TI, BGO (Bi₄Ge₃O₁₂), LaBr₃, SrI₂

We offer a wide range of single crystal and substrates, available both in standard or custom specifications. We welcome any enquiry for materials not listed below.

1. High temperature superconduct film substrates				4. Semiconductor substrates			
Crystal	Formula	Structure	Melting point (°C)	Crystal	Formula	Structure	Melting point (°C)
Lanthanum Aluminate	LaAlO ₃	Rhombo (≈Cubic) a=3.821Å	2100	Silicon	Si	Cubic a=5.0430	1415
Lanthanum Strontium Aluminium Tantalate	LSAT(LaAlO ₃) _{9/10} (Sr ₂ AlTaO ₇) _{9/10}	Cubic a=3.868Å	1840	Germanium	Ge	Cubic a=5.6575	937.4
Strontium Titanate	SrTiO ₃	Cubic a=3.90Å	2050	III-V Semiconductor substrates			
Magnesium Oxide	MgO	Cubic a=4.216Å	2852	Gallium Phosphide	GaP	Cubic	1480 °C 4.13 g/cm ³
Yttria Stabilized Zirconia	YSZ	Cubic c=5.125Å	2500	Gallium Arsenide	GaAs	Cubic a=5.653	1238 °C 5.31 g/cm ³
Neodymium Gallate	NdGaO ₃	Orthor a=5.43Å b=5.5Å c=7.71Å	1600	Indium Phosphide	InP	Cubic a=5.243	1062 °C 6.719 g/cm ³
Strontium Lanthanum Aluminate	SrLaAlO ₄	Tetrag a=3.756Å c=12.63Å	1650	Indium Arsenide	InAs	Cubic a=6.058	5.699 g/cm ³
Yttrium Aluminium Perovskite	YAlO ₃	Orthor a=5.3286Å b=7.3706Å c=5.1796Å	1870	II-V Semiconductor substrates			
2. Magnetism film and ferroelectric crystal substrate				Zinc Selenide	ZnSe	Cubic F43 m a=5.6685	1517
Lanthanum Aluminate	LaAlO ₃	Rhombo (≈Cubic) a=3.821Å	2100	Zinc Oxide	ZnO	Hexagonal P63 mc a=3.325 c=5.213	1975
Strontium Titanate	SrTiO ₃	Cubic a=3.90Å	2050				
Niobium Doped Strontium Titanate	Nb:SrTiO ₃	Cubic a=3.90Å	2050				
Aluminium oxide	Al ₂ O ₃	Hexagonal a=4.758Å c=12.99Å	2040				
Manganese Aluminate	MgAl ₂ O ₄	Cubic a=8.083Å	2130				
Gallium Gadolinium Garnet	GGG (Gd ₃ Ga ₅ O ₁₂)	Cubic a=12.37Å	1860				
Titanium Dioxide	TiO ₂	Tetrag a=4.593Å c=2.958Å	1840				
3. GaN extension film substrates				I-V Semiconductor substrates			
Aluminium oxide	Al ₂ O ₃	Hexagonal a=4.758Å c=12.99Å	2040	Lithium Niobate	LiNbO ₃	ca=b=5.148 Å, c=13.863 Å	1250
Magnesium Oxide	MgO	Cubic a=4.216Å	2852	Lithium Tantalate	LiTaO ₃	Hexagona a=b=5.153 c=13.75	1650
Lanthanum Strontium Aluminium Tantalate	LSAT(LaAlO ₃) _{9/10} (Sr ₂ AlTaO ₇) _{9/10}	Cubic a=3.868Å	1840	Quartz	SiO ₂	Hexagona a= 4.914 Å c = 5.405 Å	1610
Lithium Aluminium Oxide	LiAlO ₂	Tetrag a=5.17Å c=6.26Å	19600	Yttrium Vanadate	YVO ₄	Tetrag , a=b=7.12Å; c=6.29 Å	1825
Manganese Aluminate	MgAl ₂ O ₄	Cubic a=8.083Å	2130	Bismuth Germanate	Bi ₄ Ge ₃ O ₁₂	Cubic a=10.52	1045
Silicon Carbide	SiC	Hexagonal a=3.080Å c=15.12Å	2700	Titanium Dioxide	TiO ₂	Tetrag a=4.5936 Å, c= 2.9582 Å	1840
Zinc Oxide	ZnO	Hexagonal a=3.325Å c=5.213Å	1975				

Corporate Office
 37 Ramland Road
 Orangeburg, NY 10962

R&D / Distribution center
 2001 Oaks Parkway
 Belmont, NC 28012

+1 (845) 293 0587
 (845) 818 3593
 info@ltschem.com

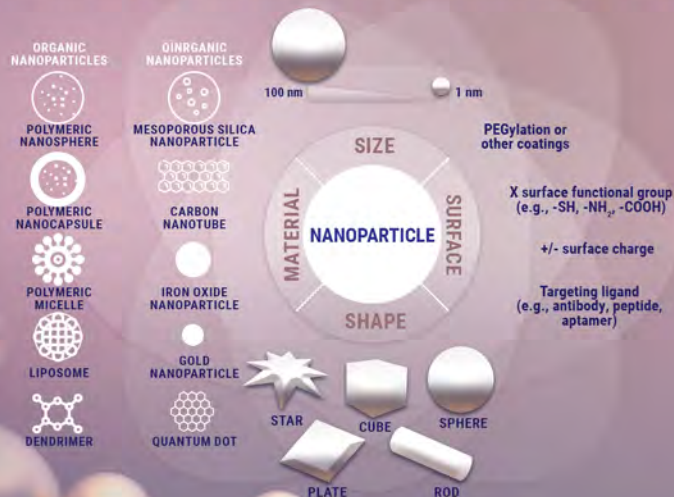


NANO PARTICLES

www.ltschem.com

Nanoparticles (NPs) with dimensions smaller than 100 nanometers can exhibit distinct, size-dependent physical and chemical properties compared to their bulk counterparts.

NPs are considered suitable candidates for numerous applications, including optics, automotive industry, pharmaceuticals, energy, aerospace, and more. NPs can be synthesized via top-down approaches (such as lithographic templating and 3D printing) and bottom-up approaches (such as emulsion polymerization techniques, amphiphile self-assembly, and polymerization-induced self-assembly).



LTS produces nanoparticles via facile and controlled synthetic techniques with excellent features

- PARTICLE SIZE DISTRIBUTION
- PARTICLE SIZE
- PHASE PURITY
- SURFACE FUNCTIONALITY
- POROSITY AND MORPHOLOGY
- HIGH-SURFACE AREA
- MONODISPERSE & UN-AGGLOMERATE
- CUSTOMIZED DESIGN IN DOPING ELEMENTS, ALLOYS, AND CORE-SHELL NANOPARTICLES

Corporate Office
📍 37 Ramland Road
Orangeburg, NY 10962

© Copyright reserved by LTS Research Laboratories, Inc.

R&D / Distribution center
📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587
☎ (845) 818 3593
✉ info@ltschem.com





CONTACT US

LTS Research Laboratories, Inc.

Corporate Office

📍 37 Ramland Road
Orangeburg, NY 10962

R&D / Distribution center

📍 2001 Oaks Parkway
Belmont, NC 28012

☎ +1 (845) 293 0587

☎ (845) 818 3593

✉ info@ltschem.com

