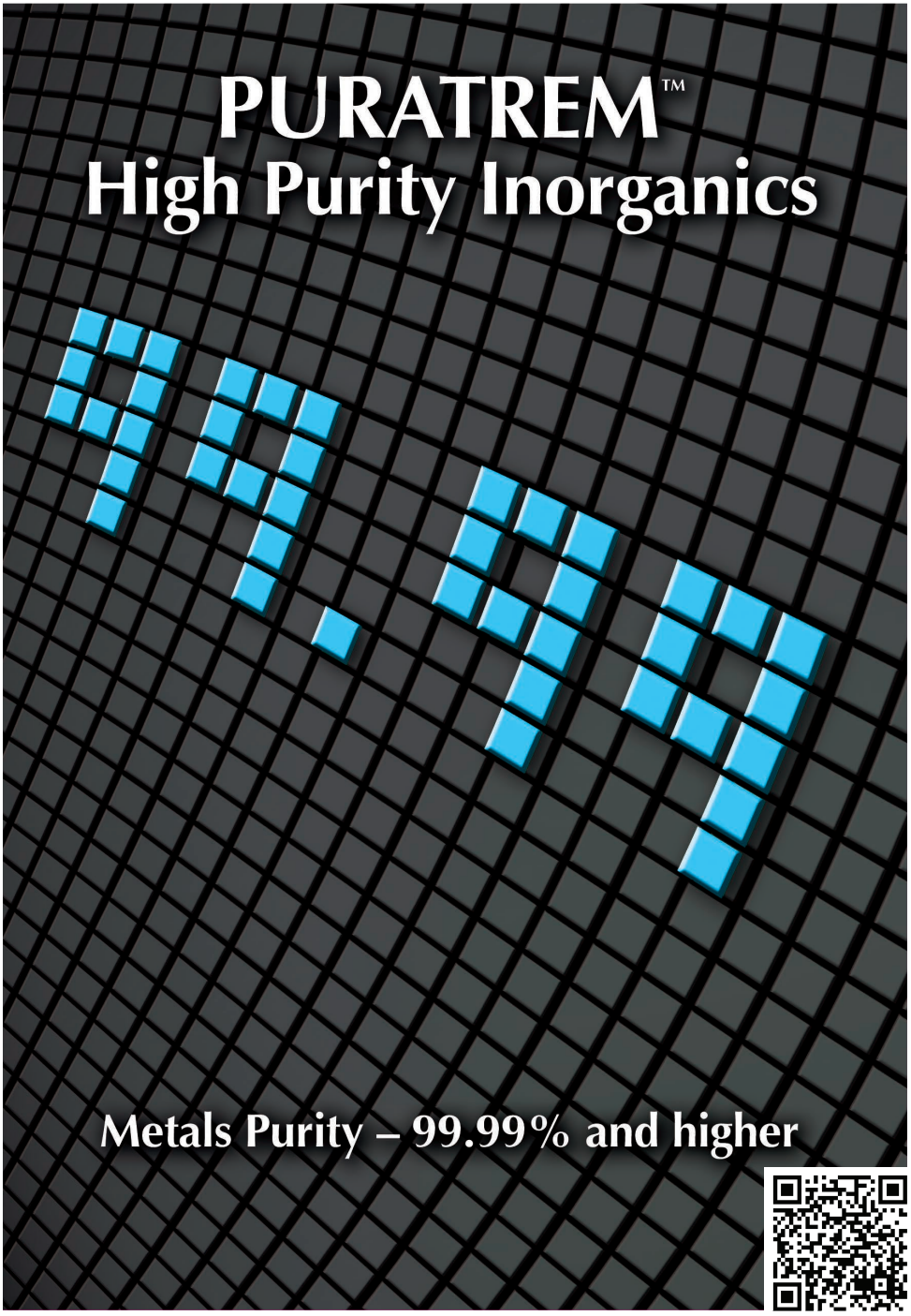
PURATREM™
High Purity Inorganics
Metals Purity – 99.99% and higher
STREM

PURATREM™ - High Purity Inorganics

Strem Chemicals, Inc. has been providing fine chemicals for research and development as well as commercial production for over fifty years. In 1988 we officially launched the "PURATREM - High Purity Inorganics" line. Each of the products presented in this booklet has a minimum purity of 99.99% (metals basis). Many of these items can be used as CVD/ALD precursors, where the product purity can play an integral part in the application results.

At Strem, we also offer a wide variety of catalysts, ligands and nanomaterials. Most of our products are of high purity, typically at 99%, while some are as high as 99.9999% metals purity. As an effort to expand our product line, we continually seek to provide new technologies from around the globe. We have licensing agreements with industry and academia, which allow easier access to these patent-protected products for our customers. We look forward to continued growth in order to best serve our customers' needs with the quality and service they can trust from Strem.

As part of our ongoing commitment to quality, we have achieved ISO 9001 certification for the Quality Management System (QMS) at our corporate headquarters in Newburyport, Massachusetts.

In addition, custom synthesis services are provided on a contract basis. For pharmaceutical applications, manufacturing is conducted under current Good Manufacturing Practices (cGMP) in FDA inspected kilo-lab suites. Complete documentation is available, including validation and stability studies. Active Drug Master Files (DMF's) are maintained in North America and Europe.

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Our other booklets, which focus on applications and product classes, are available in print per request and also as PDFs on our website. Below is a list of current booklet titles that are available. Please also check our Product Resources section online to find additional literature offerings, such as The Strem Chemiker, our technical publication, and product literature sheets.

- Biocatalysts
- Buchwald Ligands and Precatalysts
- Carbon-Base Nanomaterials & Elemental Forms
- Catalysts & Ligands Manufactured Under License of Takasago Patent
- Gold Elements & Compounds
- Heterogeneous Catalysts
- High Purity Chiral Reagents
- Kits
- Materials for Energy Applications
- Metal Catalysts for Organic Synthesis
- Metathesis Catalysts
- MOCVD, CVD & ALD Precursors
- MOFs and Ligands for MOF Synthesis
- Nanomaterials
- New Products
- Other Ligands
- Phosphorous Ligands and Compounds
- Photocatalysts
- PURATREM: High Purity Inorganics

Ephraim S. Honig, Ph.D., M.B.A
Chief Executive Officer

ISO 9001 CERTIFIED

PURATREM 07/18

Glossary of Terms

$[\alpha]_D$	.....	Specific rotation
AAS	.....	Atomic Absorption Standard
ACS	.....	Conforms to American Chemical Society specifications
air sensitive	.....	Product may chemically react with atmospheric oxygen or carbon dioxide at ambient conditions. Handle and store under an inert atmosphere of nitrogen or argon.
amp	.....	Ampouled
b.p.	.....	Boiling point in °C at 760mm, unless otherwise noted
d.	.....	Density
dec.	.....	Decomposes
elec. gr.	.....	Electronic Grade, suitable for electronic applications
f.p.	.....	Flash point in °F
gran.	.....	Granular
heat sensitive	.....	Product may chemically degrade if stored for prolonged periods of time at ambient temperatures or higher. Store at 5°C or lower.
hydrate	.....	Unspecified water content which may vary slightly from lot to lot
hygroscopic	.....	Product may absorb water if exposed to the atmosphere for prolonged periods of time (dependent on humidity and temperature). Handle and store under an inert atmosphere of nitrogen or argon.
light sensitive	.....	Product may chemically degrade if exposed to light
liq.	.....	Liquid
m.p.	.....	Melting point in °C
moisture sensitive	.....	Product may chemically react with water. Handle and store under an inert atmosphere of nitrogen or argon.
NMR grade		Suitable as a Nuclear Magnetic Resonance reference standard
optical grade	.....	For optical applications
pwdr.	.....	Powder
primary standard	.....	Used to prepare reference standards and standardize volumetric solutions
PURATREM	.....	Product has a minimum purity of 99.99% (metals basis)
purified	.....	A grade higher than technical, often used where there are no official standards
P. Vol.	.....	Pore volume
pyrophoric	.....	Product may spontaneously ignite if exposed to air at ambient conditions
reagent	.....	High purity material, generally used in the laboratory for detecting, measuring, examining or analyzing other substances
REO	.....	Rare Earth Oxides. Purity of a specific rare-earth metal expressed as a percentage of total rare-earths oxides.
SA	.....	Surface area
store cold	.....	Product should be stored at -18°C or 4°C, unless otherwise noted (see product details)
subl.	.....	Sublimes
superconductor grade	.....	A high purity, analyzed grade, suitable for preparing superconductors
tech. gr.	.....	Technical grade for general industrial use
TLC	.....	Suitable for Thin Layer Chromotography
v.p.	.....	Vapor pressure mm of Hg
xtl.	.....	Crystalline

About Purity

Chemical purity	.....	is reported after the chemical name, e.g. Ruthenium carbonyl, 99%
Metals purity	.....	is reported in parentheses with the respective element, e.g. Gallium (III) bromide, anhydrous, granular (99.999%-Ga) PURATREM where 100% minus the metal purity is equal to the maximum allowable percentage of trace metal impurity

ALUMINUM (Compounds)

13-0050 HAZ	**Aluminum chloride, anhydrous (99.99+%-Al) PURATREM** *(7446-70-0)* $AlCl_3$; FW: 133.34; -20 mesh white to yellow pwdr.; m.p. 190°; b.p. 180° subl.; d. 2.44 *moisture sensitive*	50g 250g
13-1309 HAZ	**Aluminum chloride hexahydrate (99.999%-Al) PURATREM** *(7784-13-6)* $AlCl_3 \cdot 6H_2O$; FW: 133.34 (241.43); white xtl.; m.p. 100° dec.; d. 2.398 *hygroscopic*	25g 100g
13-1310 HAZ	**Aluminum chloride hexahydrate (99.9995%-Al) PURATREM** *(7784-13-6)* $AlCl_3 \cdot 6H_2O$; FW: 133.34 (241.43); white xtl.; m.p. 100° dec.; d. 2.398 *hygroscopic*	25g 100g
13-1300	**Aluminum oxide (99.999%-Al) PURATREM** *(1344-28-1)* Al_2O_3; FW: 101.96; white pwdr.; b.p. 2980°; d. 3.97	10g 50g
97-0139 HAZ	**Aluminum i-propoxide (99.99+%-Al) PURATREM** *(555-31-7)* $Al[(OCH(CH_3)_2]_3$; FW: 204.25; white pwdr.; m.p. 118.5°; b.p. 140.5°/8 mm; d. 1.0346 *moisture sensitive*	25g 100g
13-1600 HAZ	**Dimethylaluminum i-propoxide, 98% (99.99+%-Al) PURATREM** *(6063-89-4)* $(CH_3)_2Al(OC_3H_7)$; FW: 116.14; colorless liq.; d. 0.824 *air sensitive, moisture sensitive*	1g 5g

Technical Note:

1. Useful starting material for the atomic layer deposition of Al_2O_3 films.

References:

1. *J. Vac. Sci. Tech. A.,* **2003**, *21*, 1366

98-1855 HAZ	**Triethylaluminum, elec. gr. (99.999+%-Al) PURATREM** *(97-93-8)* $(C_2H_5)_3Al$; FW: 114.17; colorless liq.; m.p. -52.5°; b.p. 186°; f.p. -1°F; d. 0.835 *moisture sensitive, pyrophoric*	100g
98-1955 HAZ	**Trimethylaluminum, elec. gr. (99.999+%-Al) PURATREM** *(75-24-1)* $(CH_3)_3Al$; FW: 72.09; colorless liq.; m.p. 15.4°; b.p. 20°/8 mm; f.p. 1.4°F; d. 0.752 (20°) *moisture sensitive, pyrophoric* Note: Available prepacked in ALD cylinder- see 98-4007, 98-4008.	25g 100g 200g
98-4008 HAZ	**Trimethylaluminum, elec. gr. (99.999+%-Al) PURATREM, 98-1955, contained in 50 ml Swagelok® cylinder (96-1070) for CVD/ALD** *(75-24-1)* $(CH_3)_3Al$; FW: 72.09; colorless liq.; m.p. 15.4°; b.p. 20°/8 mm; f.p. 1.4°F; d. 0.752 (20°) *moisture sensitive, pyrophoric*	25g
98-4007 HAZ	**Trimethylaluminum, elec. gr. (99.999+%-Al) PURATREM, 98-1955, contained in 50 ml electropolished Swagelok® cylinder (96-1077) for CVD/ALD** *(75-24-1)* $(CH_3)_3Al$; FW: 72.09; colorless liq.; m.p. 15.4°; b.p. 20°/8mm; f.p. 1.4°F; d. 0.752 (20°) *moisture sensitive, pyrophoric*	25g

AMMONIUM (Compounds)

93-0242	**Ammonium chloride (99.999%) PURATREM** *(12125-02-9)* NH_4Cl; FW: 53.49; white xtl.; m.p. 340° subl.; b.p. 520°; d. 1.527	25g 100g
02-0500	**Ammonium dihydrogen phosphate (99.998%) PURATREM** *(7722-76-1)* $NH_4H_2PO_4$; FW: 115.03; white xtl.; m.p. 190°; d. 1.803	10g 50g
02-0590	**Ammonium hexachlororhodate(III) monohydrate (99.995%-Rh) PURATREM** *(15336-18-2)* $(NH_4)_3RhCl_6 \cdot H_2O$; FW: 369.74 (387.76); red xtl. *hygroscopic*	1g 5g
93-0214	**Ammonium iodide (99.999%) PURATREM** *(12027-06-4)* NH_4I; FW: 144.94; white xtl.; m.p. 551° subl.; d. 2.514	5g 25g
02-0700 HAZ	**Ammonium metavanadate (99.995%-V) PURATREM** *(7803-55-6)* NH_4VO_3; FW: 116.98; white pwdr.; m.p. 200° dec.; d. 2.33	5g
02-0750	**Ammonium molybdate tetrahydrate (99.999%-Mo) PURATREM** *(12027-67-7)* $(NH_4)_6Mo_7O_{24} \cdot 4H_2O$; FW: 1163.80 (1235.86); white xtl.; d. 2.498	5g 25g
02-0900 HAZ	**Ammonium perrhenate (99.999%-Re) PURATREM** *(13598-65-7)* NH_4ReO_4; FW: 268.24; white pwdr.; m.p. dec.; d. 3.97	1g 5g
02-1000	**Ammonium tetrachloroaurate(III) hydrate (99.9985%-Au) PURATREM** *(13874-04-9)* $NH_4AuCl_4 \cdot XH_2O$; FW: 356.82; yellow xtl.	1g 5g

AMMONIUM (Compounds)

02-1275 **Ammonium tetrachloropalladate(II) (99.998%-Pd) PURATREM** *(13820-40-1)* — 1g, 5g
$(NH_4)_2PdCl_4$; FW: 284.29; red to brown pwdr.; m.p. dec.; d. 2.17

42-1000 **Ammonium tetrathiomolybdate(VI), 99% (99.99%-Mo) PURATREM** *(15060-55-6)* — 5g, 25g
$(NH_4)_2MoS_4$; FW: 260.27; red-green xtl.
air sensitive, (store cold)

93-0250 **Ammonium tungstate pentahydrate (99.996%-W) PURATREM** — 10g, 50g
(1311-93-9)
$(NH_4)_{10}W_{12}O_{41}\cdot 5H_2O$; FW: 3042.56 (3132.63); white xtl.

ANTIMONY (Compounds)

97-0373 amp HAZ **Antimony(III) chloride, elec. gr. (99.999%-Sb) PURATREM** *(10025-91-9)* — 5g, 25g
$SbCl_3$; FW: 228.11; off-white xtl.; m.p. 73.4°; b.p. 283°; d. 3.140
moisture sensitive

51-2200 amp HAZ **Antimony(V) chloride, (99.999%-Sb) PURATREM** *(7647-18-9)* — 5g, 25g
$SbCl_5$; FW: 299.02; yellow liq.; m.p. 2.8°; b.p. 79°/22mm; d. 2.336
moisture sensitive

97-0380 HAZ **Antimony(III) oxide, elec. gr. (99.999%-Sb) PURATREM** *(1309-64-4)* — 25g, 100g
Sb_2O_3; FW: 291.50; white pwdr.; m.p. 656°; b.p. 1550° subl.; d. 5.67

51-5110 HAZ **Antimony(IV) oxide (99.99%-Sb) PURATREM** *(1332-81-6)* — 5g, 25g
Sb_2O_4; FW: 307.50; white to off-white pwdr.; d. 5.82

97-0382 HAZ **Antimony(V) oxide, elec. gr. (99.998%-Sb) PURATREM** *(1314-60-9)* — 5g, 25g, 100g
Sb_2O_5; FW: 323.50; white to light yellow pwdr.; d. 3.80

93-5120 HAZ **Antimony(III) sulfide (99.999%-Sb) PURATREM** *(1345-04-6)* — 10g, 50g
Sb_2S_3; FW: 339.68; black pwdr.; m.p. 550°; b.p. ~1150°; d. 4.12

51-5000 HAZ **Tris(dimethylamino)antimony (99.99%-Sb) PURATREM** *(7289-92-1)* — 1g, 5g, 25g
$((CH_3)_2N)_3Sb$; FW: 253.99; colorless liq.; b.p. 32-34°/0.45mm; d. 1.325
air sensitive, moisture sensitive

ARSENIC (Compounds)

93-3309 amp HAZ **Arsenic(III) chloride (99.999%-As) PURATREM** *(7784-34-1)* — 5g, 25g, 100g
$AsCl_3$; FW: 181.27; colorless liq.; m.p. -8.5°; b.p. 130.2°; d. 2.163
moisture sensitive

97-0425 HAZ **Arsenic(III) oxide, elec. gr. (99.999%-As) PURATREM** *(1327-53-3)* — 5g, 25g, 100g
As_2O_3; FW: 197.84; white pwdr.; m.p. 315°; b.p. 465° subl.; d. 3.738

93-3305 **Arsenic(III) selenide (99.999%-As) PURATREM** *(1303-36-2)* — 5g, 25g
As_2Se_3; FW: 386.72; black xtl.; m.p. ~360°; d. 4.75

33-1199 HAZ **Arsenic(III) sulfide, fused lumps (99.999%-As) PURATREM** *(1303-33-9)* — 10g, 50g
As_2S_3; FW: 246.03; fused lumps; m.p. 300°; b.p. 707°; d. 3.43
moisture sensitive

98-1975 amp HAZ **Trimethylarsine, elec. gr. (99.995%-As) PURATREM** *(593-88-4)* — 25g
$(CH_3)_3As$; FW: 120.03; colorless liq.; m.p. -87.3°; b.p. 51°; f.p. 100°F; d. 1.124
air sensitive

BARIUM (Compounds)

56-5656 **Barium bis(N,N,N',N',N''-pentamethyldiethylenetriamine)bis[BREW] (99.99+%-Ba) PURATREM** — 1g, 5g, 25g
$Ba(C_9H_{23}N_3)_2[C_xH_yC(O)CHC(O)C_xH_y]_2$ (x=3-4, y=2x +1); pale yellow liq.
moisture sensitive
Note: 13-16 wt% Ba; ***Limited quantities available. Will discontinue when stock gone***

Technical Note:

1. H-BREW is a mixture of propyl and butyl substituted beta-diketonates capable of forming a wide variety of metal complexes suitable for MOCVD. In most cases, the metal complexes are liquids, are completely miscible with polar and non-polar organic solvents and are miscible with other metal complexes in essentially all proportions.

56-1025 HAZ **Barium carbonate (99.999%-Ba) PURATREM** *(513-77-9)* — 10g, 50g
$BaCO_3$; FW: 197.35; white pwdr.; d. 4.43

BARIUM (Compounds)

56-1030 HAZ	**Barium chloride dihydrate (99.999%-Ba) PURATREM** *(10326-27-9)* $BaCl_2 \cdot 2H_2O$; FW: 208.24 (244.28); white xtl.; d. 3.097	10g 50g
93-5613 HAZ	**Barium fluoride (99.99+%-Ba) PURATREM** *(7787-32-8)* BaF_2; FW: 175.34; white pwdr.; m.p. 1280°; b.p. 2137°; d. 4.89	10g 50g
56-7500 HAZ	**Barium nitrate (99.999%-Ba) PURATREM** *(10022-31-8)* $Ba(NO_3)_2$; FW: 261.35; white xtl.; m.p. 592°; d. 3.230 *hygroscopic*	10g 50g
56-8600 HAZ	**Bis(2,2,6,6-tetramethyl-3,5-heptanedionato)barium tetraglyme adduct (99.99%-Ba, Sr-0.5%) PURATREM** *(136629-60-2)* $Ba(C_{11}H_{19}O_2)_2 \cdot CH_3(OCH_2CH_2)_4OCH_3$; FW: 503.85 (726.13); white xtl.; m.p. 103°	1g 5g
56-8610 HAZ	**Bis(2,2,6,6-tetramethyl-3,5-heptanedionato)barium triglyme adduct (99.99%-Ba, Sr-0.5%) PURATREM** *(149160-45-2)* $Ba(C_{11}H_{19}O_2)_2 \cdot CH_3(OCH_2CH_2)_3OCH_3$; FW: 503.85 (682.09); off-white pwdr.; m.p. 88°	1g 5g

BISMUTH (Compounds)

93-8315	**Bismuth(III) chloride, anhydrous (99.999%-Bi) PURATREM** *(7787-60-2)* $BiCl_3$; FW: 315.34; white xtl.; m.p. 230-232°; b.p. 447°; d. 4.75 *moisture sensitive*	5g 25g
83-2401 HAZ	**Bismuth(III) 2-ethylhexanoate, 70-75% in xylenes (~24% Bi) (99.99+%-Bi) PURATREM** *(67874-71-9)* $Bi[OOCCH(C_2H_5)C_4H_9]_3$; FW: 638.61; light yellow liq.	25g 100g
83-3000	**Bismuth(III) fluoride (99.99+%-Bi) PURATREM** *(7787-61-3)* BiF_3; FW: 265.98; white to gray xtl.; m.p. 727°; d. 5.32 *moisture sensitive*	10g 50g
93-8317 HAZ	**Bismuth(III) iodide (99.999%-Bi) PURATREM** *(7787-64-6)* BiI_3; FW: 589.69; gray pwdr.; m.p. 408°; b.p. ~500°; d. 5.778 *moisture sensitive*	5g 25g
93-8303 HAZ	**Bismuth(III) nitrate pentahydrate (99.999%-Bi) PURATREM** *(10035-06-0)* $Bi(NO_3)_3 \cdot 5H_2O$; FW: 394.99 (485.07); white xtl.; d. 2.83 *moisture sensitive*	5g 25g 100g
93-8319	**Bismuth(III) oxide (99.999%-Bi) PURATREM** *(1304-76-3)* Bi_2O_3; FW: 465.96; yellow pwdr.; m.p. 817°; b.p. 1890°; d. 8.9	25g 100g 500g
83-4025	**Bismuth(III) oxide (99.9998%-Bi) PURATREM** *(1304-76-3)* Bi_2O_3; FW: 465.96; yellow pwdr.; m.p. 817°; b.p. 1890°; d. 8.9	25g 100g
93-8351	**Bismuth(III) sulfide (99.999%-Bi) PURATREM** *(1345-07-9)* Bi_2S_3; FW: 514.15; gray to black pwdr.; m.p. 685° dec.; d. 7.39	10g 50g
83-4075	**Bismuth(III) telluride (99.99%-Bi) PURATREM** *(1304-82-1)* Bi_2Te_3; FW: 800.76; black pwdr.; m.p. 573°	5g 25g

BORON (Compounds)

93-0559	**Boric acid (99.99%-B) PURATREM** *(10043-35-3)* H_3BO_3; FW: 61.83; white xtl.; m.p. 171°; d. 1.435	250g 1kg
05-0205	**Boric acid (99.9995%-B) PURATREM** *(10043-35-3)* H_3BO_3; FW: 61.83; white xtl.; m.p. 171°; d. 1.435	10g 50g
97-1725 amp HAZ	**Boron bromide, elec. gr. (99.999%-B) PURATREM** *(10294-33-4)* BBr_3; FW: 250.54; pale yellow to orange liq.; m.p. -46°; b.p. 91.3°; d. 2.6431 *moisture sensitive*	5g 25g 100g

BROMINE (Compounds)

06-0201	**Carbon tetrabromide, vacuum sublimed (99.998%-C) PURATREM** *(558-13-4)* *See* page 4	

CADMIUM (Compounds)

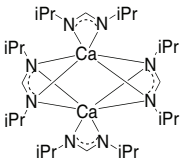
48-0100 HAZ	**Cadmium acetate, anhydrous (99.999%-Cd) PURATREM** *(543-90-8)* $Cd(OOCCH_3)_2$; FW: 230.50; white pwdr.; m.p. 232-235°	5g 25g

CADMIUM (Compounds)

48-0150 HAZ	**Cadmium arsenide (99.999%-Cd) PURATREM** *(12006-15-4)* Cd_3As_2; FW: 487.07; dark gray solid; d. 3.031 *moisture sensitive*	5g 25g
48-1500 HAZ	**Cadmium chloride, anhydrous (99.995%-Cd) PURATREM** *(10108-64-2)* $CdCl_2$; FW: 183.32; white pwdr.; m.p. 568°; b.p. 960°; d. 4.047 *hygroscopic*	10g 50g
48-0200 HAZ	**Cadmium chloride hydrate (99.998%-Cd) PURATREM** *(34330-64-8)* $CdCl_2 \cdot XH_2O$; FW: 183.32; white xtl.	5g 25g
48-1501 amp HAZ	**Cadmium chloride, (99.999%-Cd) (O_2 < 50ppm) PURATREM** *(10108-64-2)* $CdCl_2$; FW: 183.32; -20 mesh white pwdr. (under argon); m.p. 568°; b.p. 960°; d. 4.047 *hygroscopic*	5g 25g
93-4817 HAZ	**Cadmium oxide (99.99%-Cd) PURATREM** *(1306-19-0)* CdO; FW: 128.40; reddish-brown pwdr.; m.p. 1430°; d. 8.15	250g 1kg
48-0800 HAZ	**Cadmium oxide (99.999%-Cd) PURATREM** *(1306-19-0)* CdO; FW: 128.40; red to brown pwdr.; m.p. 1430°; d. 8.15	25g 100g 500g
93-4836 HAZ	**Cadmium selenide (99.999+%-Cd) PURATREM** *(1306-24-7)* CdSe; FW: 191.36; black pwdr.; m.p. > 1350°; d. 5.81	5g 25g
93-4840 HAZ	**Cadmium sulfide (99.999%-Cd) PURATREM** *(1306-23-6)* CdS; FW: 144.46; yellow to orange pwdr.; m.p. 1750°; d. 4.82	10g 50g 250g
48-2000 HAZ	**Cadmium telluride (99.999%-Cd) PURATREM** *(1306-25-8)* CdTe; FW: 240.00; -200 mesh black pwdr.; m.p. 1041°; d. 6.20	5g 25g
93-4825 HAZ	**Cadmium telluride (99.999%-Cd) PURATREM** *(1306-25-8)* CdTe; FW: 240.00; black lumps; m.p. 1041°; d. 6.20	10g 50g
97-5040 HAZ	**Dimethylcadmium, elec. gr. (99.995+%-Cd) PURATREM** *(506-82-1)* $(CH_3)_2Cd$; FW: 142.88; colorless liq.; m.p. -4.5°; b.p. 105.5°; f.p. -1°F; d. 1.985 (18°) *moisture sensitive, pyrophoric* Note: Material may contain a small amount of precipitate.	25g 100g

CALCIUM (Compounds)

20-8200 NEW	**Bis(N,N'-diisopropylformamidinato)calcium(II) dimer, (99.99 %-Ca) PURATREM** *(1959584-78-1)* $C_{28}H_{60}Ca_2N_8$; FW: 588.99; tan to light-brown pwdr. *air sensitive, moisture sensitive* Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard2.	1g 5g



Technical Note:

1. Calcium amidinate precursor for the atomic layer deposition (ALD) of calcium containing thin films.

References:

1. *Angew. Chem. Int. Ed.*, **2016**, *55*, 10228 –10233.

20-0200	**Calcium carbonate (99.999%-Ca) PURATREM** *(471-34-1)* $CaCO_3$; FW: 100.09; white pwdr.; d. 2.930	10g 50g
20-2060	**Calcium chloride hydrate (99.999+%-Ca) PURATREM** *(22691-02-7)* $CaCl_2 \cdot XH_2O$; FW: 110.99; white pwdr.	5g 25g 100g

CARBON (Compounds)

06-0201 amp HAZ	**Carbon tetrabromide, vacuum sublimed (99.998%-C) PURATREM** *(558-13-4)* CBr_4; FW: 331.65; white xtl.; m.p. 88-90°; b.p. 190°	25g 100g

CERIUM (Compounds)

58-5801	**Cerium(III) acetate hydrate (99.999%-Ce) (REO) PURATREM** *(206996-60-3)* $Ce(OOCCH_3)_3 \cdot XH_2O$; FW: 317.26; white pwdr.	25g 100g
58-0200	**Cerium(III) chloride hydrate (99.99%-Ce) (REO) PURATREM** *(19423-76-8)* $CeCl_3 \cdot XH_2O$; FW: 246.48; white to pale yellow xtl.	25g 100g
93-5814 HAZ	**Cerium(III) nitrate hexahydrate (99.99%-Ce) (REO) PURATREM** *(10294-41-4)* $Ce(NO_3)_3 \cdot 6H_2O$; FW: 326.17 (434.23); white xtl.	10g 50g

CERIUM (Compounds)

58-0800	**Cerium(IV) oxide (99.995%-Ce) PURATREM** *(1306-38-3)* CeO_2; FW: 172.12; yellow pwdr.; m.p. ~2600°; d. 7.132	5g 25g

CESIUM (Compounds)

93-5542	**Cesium chloride (99.999%-Cs) PURATREM** *(7647-17-8)* CsCl; FW: 168.36; white xtl.; m.p. 646°; b.p. 1290°; d. 3.988 *hygroscopic*	10g 50g
93-5544	**Cesium iodide (99.999%-Cs) PURATREM** *(7789-17-5)* CsI; FW: 259.81; white xtl.; m.p. 621°; b.p. 1280°; d. 4.510 *hygroscopic*	10g 50g
93-5545 HAZ	**Cesium nitrate (99.99%-Cs) PURATREM** *(7789-18-6)* $CsNO_3$; FW: 194.91; white xtl.; m.p. 414°; d. 3.685 *hygroscopic*	10g 50g

COBALT (Compounds)

27-1025 **NEW**	**Bis(1,4-di-t-butyl-1,3-diazabutadienyl)cobalt(II) Co(DAD)$_2$, min. 98% (99.999%-Co) PURATREM** *(177099-51-3)* $C_{20}H_{40}CoN_4$; FW: 395.49; dark green-blue xtl. *air sensitive* Note: U.S. Patent Application No. 13/818,154. Product sold under, use subject to, terms and conditions of label license at www.strem.com/waynestate1	250mg 1g 5g
27-0486 **NEW** amp HAZ	**Bis(N,N'-di-i-propylacetamidinato)cobalt(II), min. 98% (99.99%-Co) PURATREM (Co(iPr-MeAMD)$_2$** *(635680-58-9)* $C_{16}H_{34}CoN_4$; FW: 341.40; green xtl. *air sensitive, moisture sensitive* Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard2.	250mg 1g 5g
27-0405 **NEW** HAZ	**Cobalt(II) chloride, anhydrous (99.999%-Co) PURATREM** *(7646-79-9)* $CoCl_2$; FW: 129.84; blue pwdr. *hygroscopic*	1g 5g 25g
93-2735	**Cobalt(II) chloride hexahydrate (99.999%-Co) PURATREM** *(7791-13-1)* $CoCl_2 \cdot 6H_2O$; FW: 129.84 (237.93); red xtl.; m.p. 86°; d. 1.924	5g 25g
93-2746 HAZ	**Cobalt(II) nitrate hexahydrate (99.999%-Co) PURATREM** *(10026-22-9)* $Co(NO_3)_2 \cdot 6H_2O$; FW: 182.99 (291.05); red to purple xtl.; m.p. 55-56°; d. 1.87	5g 25g
27-0490	**Cobalt(II,III) oxide (99.9985%-Co) PURATREM** *(1308-06-1)* Co_3O_4; FW: 240.80; gray to black pwdr.	5g 25g
93-2750	**Cobalt(II) sulfate heptahydrate (99.999%-Co) PURATREM** *(10026-24-1)* $CoSO_4 \cdot 7H_2O$; FW: 155.00 (281.10); pink to red xtl.; m.p. 96.8°; d. 1.948	10g 50g
93-2708	**Hexaamminecobalt(III) chloride (99.999%-Co) PURATREM** *(10534-89-1)* $[Co(NH_3)_6]Cl_3$; FW: 267.46; orange pwdr.; m.p. 217°; d. 1.710	10g 50g

COPPER (Compounds)

29-0360 HAZ	**Copper(I) chloride (99.99%-Cu) PURATREM** *(7758-89-6)* CuCl; FW: 98.99; light-gray to pale green solid; m.p. 430°; b.p. 1490°; d. 4.14 *air sensitive, light sensitive*	10g 50g
93-2985 HAZ	**Copper(II) chloride dihydrate (99.999%-Cu) PURATREM** *(10125-13-0)* $CuCl_2 \cdot 2H_2O$; FW: 134.44 (170.48); green xtl.; d. 2.54	10g 50g
29-2928	**Copper(II) hexafluoroacetylacetonate, anhydrous, elec. gr. (99.99+%-Cu) PURATREM** *(14781-45-4)* $Cu(CF_3COCHCOCF_3)_2$; FW: 477.64; blue xtl. *moisture sensitive*	1g 5g
29-2929	**Copper(II) hexafluoroacetylacetonate hydrate, elec. gr. (99.99+%-Cu) PURATREM** *(14781-45-4)* $Cu(CF_3COCHCOCF_3)_2 \cdot XH_2O$; FW: 477.64; green to blue xtl.; m.p. 85-89°; b.p. dec. 220° (subl. 70°/0.05mm) *hygroscopic*	1g 5g 25g

COPPER (Compounds)

29-0485	**Copper(I) iodide (99.999%-Cu) PURATREM** *(7681-65-4)* CuI; FW: 190.45; off-white to pale brown pwdr.; m.p. 605°; b.p. 1290°; d. 5.62	10g 50g
93-2940 HAZ	**Copper(II) nitrate trihydrate (99.999%-Cu) PURATREM** *(10031-43-3)* $Cu(NO_3)_2 \cdot 3H_2O$; FW: 187.56 (241.60); blue xtl.; m.p. 114.5°; d. 2.32	5g 25g 100g
29-0590	**Copper(II) oxide (99.995%-Cu) PURATREM** *(1317-38-0)* CuO; FW: 79.55; 80-100 mesh black pwdr.; m.p. 1362°; d. 6.3-6.49	10g 50g
93-2959	**Copper(II) sulfate pentahydrate (99.999%-Cu) PURATREM** *(7758-99-8)* $CuSO_4 \cdot 5H_2O$; FW: 159.60 (249.68); blue xtl.; m.p. 110° dec.; d. 2.284	5g 25g 100g

DYSPROSIUM (Compounds)

93-6616	**Dysprosium(III) oxide (99.998%-Dy) (REO) PURATREM** *(1308-87-8)* Dy_2O_3; FW: 372.99; white pwdr.; m.p. 2330-2350°; d. 7.81	5g 25g

ERBIUM (Compounds)

68-6804	**Erbium(III) chloride hydrate (99.999%-Er) (REO) PURATREM** *(10025-75-9)* $ErCl_3 \cdot XH_2O$; FW: 273.64; pink xtl. *hygroscopic*	10g 50g
68-6805	**Erbium(III) chloride hydrate (99.999+%-Er) (low Ca, Fe, Mg) PURATREM** *(10025-75-9)* $ErCl_3 \cdot XH_2O$; FW: 273.64; pink xtl. *hygroscopic*	10g 50g
93-6820	**Erbium(III) oxide (99.995%-Er) (REO) PURATREM** *(12061-16-4)* Er_2O_3; FW: 382.51; rose pwdr.; m.p. 2400°; d. 8.640	5g 25g

EUROPIUM (Compounds)

93-6322	**Europium(III) fluoride, anhydrous (99.99%-Eu) (REO) PURATREM** *(13765-25-8)* EuF_3; FW: 208.96; white pwdr.; m.p. 1390°; b.p. 2280° *hygroscopic*	1g 5g
93-6312	**Europium(III) oxide (99.99%-Eu) (REO) PURATREM** *(1308-96-9)* Eu_2O_3; FW: 351.92; white pwdr.; d. 7.42	5g 25g 100g
93-6330	**Europium(III) sulfate octahydrate (99.99%-Eu) (REO) PURATREM** *(10031-55-7)* $Eu_2(SO_4)_3 \cdot 8H_2O$; FW: 592.11 (736.23); white xtl.	1g 5g

GADOLINIUM (Compounds)

64-3000	**Gadolinium(III) carbonate hydrate (99.99%-Gd) (REO) PURATREM** *(38245-36-2)* $Gd_2(CO_3)_3 \cdot XH_2O$; FW: 494.53; white pwdr.	10g 50g
93-6406	**Gadolinium(III) oxide (99.99%-Gd) (REO) PURATREM** *(12064-62-9)* Gd_2O_3; FW: 362.50; white pwdr.; m.p. 2310°; d. 7.407	100g 500g

GALLIUM (Compounds)

93-3130	**Gallium(III) acetylacetonate (99.99+%-Ga) PURATREM** *(14405-43-7)* $Ga(CH_3COCHCOCH_3)_3$; FW: 367.05; white to pale yellow pwdr.; m.p. 192-194° dec. >280°; b.p. 140°/10 mm subl.; d. 1.42	5g 25g
93-3103 HAZ	**Gallium arsenide (99.9999%-Ga) PURATREM** *(1303-00-0)* GaAs; FW: 144.64; 25mm and down polycrystalline pieces; m.p. 1238°; d. 5.31	1g 5g
93-3109 HAZ	**Gallium(III) bromide, anhydrous, granular (99.999%-Ga) PURATREM** *(13450-88-9)* $GaBr_3$; FW: 309.45; white granules; m.p. 121.5°; b.p. 278.8°; d. 3.69 *moisture sensitive*	1g 5g

GALLIUM (Compounds)

93-3104 amp HAZ	**Gallium(II) chloride, anhydrous (99.999%-Ga) PURATREM** *(13498-12-9)* Ga_2Cl_4; FW: 281.26; white xtl.; m.p. 164°; b.p. 535° *moisture sensitive*	1g 5g
93-3141 amp HAZ	**Gallium(III) chloride, anhydrous, fused lump (99.999%-Ga) PURATREM** *(13450-90-3)* $GaCl_3$; FW: 176.03; white fused lump; m.p. 77.9°; b.p. 201.3°; d. 2.47 *moisture sensitive*	5g 25g 100g
93-3140 HAZ	**Gallium(III) chloride, anhydrous, granular (99.999%-Ga) PURATREM** *(13450-90-3)* $GaCl_3$; FW: 176.03; white crystalline pwdr.; m.p. 77.9°; b.p. 201.3°; d. 2.47 *moisture sensitive* Note: Packaged in PFA/FET bottle.	5g 25g 100g
31-1370 NEW	**Gallium (III) fluoride trihydrate (99.99%-Ga) PURATREM** *(7783-51-9)* $GaF_3 \cdot 3H_2O$; FW: 126.72 (180.76); white xtl. *hygroscopic*	1g 5g
93-3105 HAZ	**Gallium(III) nitrate hydrate (99.99%-Ga) PURATREM** *(69365-72-6)* $Ga(NO_3)_3 \cdot XH_2O$; FW: 255.73; white xtl.; m.p. 110° dec. *hygroscopic*	5g 25g
93-3106	**Gallium(III) oxide (99.998%-Ga) PURATREM** *(12024-21-4)* Ga_2O_3; FW: 187.44; white pwdr.; m.p. 1900°; d. 5.88	5g 25g 100g
93-3123	**Gallium phosphide (99.999%-Ga) PURATREM** *(12063-98-8)* GaP; FW: 100.69; amber xtl.; m.p. 1348°; d. 4.1	2g 10g
93-3126	**Gallium(III) sulfate hydrate (99.999%-Ga) PURATREM** *(13780-42-2)* $Ga_2(SO_4)_3 \cdot XH_2O$; FW: 427.62; white xtl.; d. 3.86 *hygroscopic*	5g
98-1862 HAZ	**Triethylgallium, elec. gr. (99.9999%-Ga) PURATREM** *(1115-99-7)* $(C_2H_5)_3Ga$; FW: 156.91; colorless liq.; m.p. -82.3°; b.p. 143°; f.p. 69.8°F; d. 1.0586 *moisture sensitive, pyrophoric*	50g 100g
98-2000 HAZ	**Trimethylgallium, elec. gr. (99.9999%-Ga) PURATREM** *(1445-79-0)* $(CH_3)_3Ga$; FW: 114.83; colorless liq.; m.p. -15.8°; b.p. 55.7°; f.p. -1°F; d. 1.151 *moisture sensitive, pyrophoric* Note: Available prepacked in ALD cylinder- see 98-4047.	50g 100g
98-4047 HAZ	**Trimethylgallium, elec. gr. (99.9999%-Ga) PURATREM, 98-2000, contained in 50 ml electropolished Swagelok® cylinder (96-1077) for CVD/ALD** *(1445-79-0)* $(CH_3)_3Ga$; FW: 114.83; colorless liq.; m.p. -15.8°; b.p. 55.7°; f.p. -1°F; d. 1.151 *moisture sensitive, pyrophoric*	10g 25g
31-5000	**Tris(2,2,6,6-tetramethyl-3,5-heptanedionato)gallium(III), 99% (99.999%-Ga) [Ga(TMHD)$_3$] PURATREM** *(34228-15-4)* $Ga(C_{11}H_{19}O_2)_3$; FW: 619.54; white xtl.; m.p. 219-220°; b.p. dec. 360° (subl. 170°/0.2mm)	1g 5g 25g

GERMANIUM (Compounds)

93-3225 amp HAZ	**Germanium(IV) bromide (99.99+%-Ge) PURATREM** *(13450-92-5)* $GeBr_4$; FW: 392.23; white xtl.; m.p. 26.1°; b.p. 186.5°; d. 3.132 *moisture sensitive*	10g
32-0650 amp HAZ	**Germanium(IV) chloride (99.99%-Ge) PURATREM** *(10038-98-9)* $GeCl_4$; FW: 214.40; colorless liq.; m.p. -49.5°; b.p. 83.1°; d. 1.880 *moisture sensitive*	10g 50g
32-0700 amp HAZ	**Germanium(IV) chloride (99.9999%-Ge) PURATREM** *(10038-98-9)* $GeCl_4$; FW: 214.40; colorless liq.; m.p. -49.5°; b.p. 83.1°; d. 1.880 *moisture sensitive*	25g 100g 5 x 100g

GERMANIUM (Compounds)

93-3206 HAZ
Germanium(IV) ethoxide (99.99+%-Ge) PURATREM *(14165-55-0)* — 1g, 5g, 25g
$Ge(OC_2H_5)_4$; FW: 252.85; colorless liq.; m.p. -81°; b.p. 185.5°; d. 1.14
moisture sensitive

93-3205
Germanium(II) iodide (99.99+%-Ge) PURATREM *(13573-08-5)* — 1g, 5g
GeI_2; FW: 326.40; -10 mesh yellow pwdr.; m.p. dec.; d. 5.73
moisture sensitive

93-3226 amp HAZ
Germanium(IV) iodide (99.999%-Ge) PURATREM *(13450-95-8)* — 5g, 25g
GeI_4; FW: 580.21; orange to red xtl.; m.p. 146°; b.p. 350°; d. 4.416
moisture sensitive

93-3221
Germanium(IV) oxide (99.999%-Ge) PURATREM *(1310-53-8)* — 5g, 25g
GeO_2; FW: 104.59; white pwdr., hexagonal (soluble) form;
m.p. 1111-1119°; d. 4.228

97-3222
Germanium(IV) oxide, elec. gr. (99.9999%-Ge) PURATREM — 10g, 50g
(1310-53-8)
GeO_2; FW: 104.59; white pwdr.; m.p. 1111-1119°; d. 4.228

93-3224
Germanium(IV) selenide (99.999%-Ge) PURATREM *(12065-11-1)* — 1g, 5g
$GeSe_2$; FW: 230.51; orange xtl.; m.p. 707°; d. 4.56

93-3209
Germanium(II) sulfide (99.99+%-Ge) (contains 1-5% germanium metal) PURATREM *(12025-32-0)* — 2g, 10g
GeS; FW: 104.65; black xtl.; m.p. 530°

GOLD (Compounds)

02-1000
Ammonium tetrachloroaurate(III) hydrate (99.9985%-Au) PURATREM *(13874-04-9)*
See page 1

79-1900
Gold(I) chloride, 97% (99.99%-Au) PURATREM *(10294-29-8)* — 250mg, 1g, 5g
AuCl; FW: 232.42; yellow pwdr.; m.p. 289° dec.; d. 7.4

79-2200 HAZ
Hydrogen tetrachloroaurate(III) hydrate (99.9985%-Au) (49% Au) PURATREM *(27988-77-8)* — 1g, 5g
$HAuCl_4 \cdot XH_2O$; FW: 339.79; yellow to orange xtl.
light sensitive, hygroscopic, (store cold)

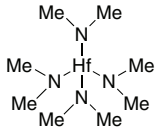
93-7906
Potassium tetrachloroaurate(III) hydrate (99.99%-Au) (51%-Au) PURATREM *(13682-61-6)*
See page 15

HAFNIUM (Compounds)

72-5200
Hafnium(IV) oxide (99.995%-Hf, <0.15% Zr) PURATREM *(12055-23-1)* — 1g, 5g
HfO_2; FW: 210.49; off-white pwdr.; m.p. 2812°; d. 9.68

72-7750 amp HAZ
Tetrakis(diethylamino)hafnium, 99% (99.99+%-Hf, <0.2% Zr) PURATREM *(19824-55-6)* — 1g, 5g, 25g
$Hf[N(CH_2CH_3)_2]_4$; FW: 467.01; light yellow liq.
moisture sensitive

72-8000 HAZ
Tetrakis(dimethylamino)hafnium, 98+% (99.99+%-Hf, <0.2% Zr) TDMAH, PURATREM *(19782-68-4)* — 1g, 5g, 25g
$Hf(N(CH_3)_2)_4$; FW: 354.79; colorless to pale yellow xtl.;
m.p. 38-41°; b.p. 85°/0.1mm; d. 1.098
moisture sensitive, (store cold)
Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard1.
Available prepacked in ALD cylinder- see 98-4021, 98-4022.



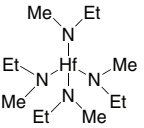
98-4021 HAZ
Tetrakis(dimethylamino)hafnium, 98+% (99.99+%-Hf, <0.2%-Zr) TDMAH, PURATREM, 72-8000, contained in 50 ml Swagelok® cylinder (96-1070) for CVD/ALD *(19782-68-4)* — 25g
$Hf(N(CH_3)_2)_4$; FW: 354.79; colorless to pale yellow xtl.; m.p. 38-41°; b.p. 85°/0.1mm
moisture sensitive, (store cold)
Note: High temperature Swagelok® cylinder assembly 96-1071 available at extra cost.
See 98-4022. Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard1.

98-4022 HAZ
Tetrakis(dimethylamino)hafnium, 98+% (99.99+%-Hf, <0.2%-Zr) TDMAH, PURATREM, 72-8000, contained in 50ml Swagelok® cylinder (96-1071) for CVD/ALD *(19782-68-4)* — 25g
$Hf(N(CH_3)_2)_4$; FW: 354.79; colorless to pale yellow xtl.
moisture sensitive, (store cold)
Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard1.

HAFNIUM (Compounds)

72-7720
amp
HAZ

Tetrakis(ethylmethylamino)hafnium, 99% (99.99+%-Hf, <0.15% Zr) TEMAH PURATREM *(352535-01-4)*
$Hf[N(CH_3)(CH_2CH_3)]_4$; FW: 410.90; colorless to yellow liq.; b.p. 79°/0.1mm; d. 1.324
moisture sensitive
Note: Available prepacked in ALD cylinder- see 98-4048.
Volatile precursor for the ALD, CVD and MOCVD deposition of hafnium oxide.



2g
10g

98-4048
HAZ

Tetrakis(ethylmethylamino)hafnium, 99% (99.99+%-Hf, <0.15% Zr) TEMAH, PURATREM, 72-7720, contained in 50 ml Swagelok® cylinder (96-1070) for CVD/ALD *(352535-01-4)*
$Hf[N(CH_3)(CH_2CH_3)]_4$; FW: 410.90; colorless to yellow liq.; f.p. 52°F
moisture sensitive
Note: High temperature Swagelok® cylinder assembly 96-1071 available at extra cost.

10g

INDIUM (Compounds)

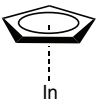
98-4057
HAZ

Cyclopentadienylindium (I), elec. gr. (99.99+%-In) PURATREM, 97-3425, contained in 50 ml Swagelok® cylinder (96-1070) for CVD/ALD *(34822-89-4)*
C_5H_5In; FW: 179.92; off-white to light yellow xtl.; b.p. subl. 50°/0.01mm
air sensitive, heat sensitive, light sensitive

5g

97-3425
HAZ

Cyclopentadienylindium(I), elec. gr. (99.99+%-In) PURATREM *(34822-89-4)*
C_5H_5In; FW: 179.92; off-white to light yellow xtl.; b.p. subl. 50°/0.01 mm
air sensitive, heat sensitive, light sensitive
Note: Available prepacked in ALD cylinder- see 98-4057, 98-4054.



250mg
1g
5g

Technical Note:
1. ALD precursor for Indium oxide using cyclopentadienyl indium and mixture of water and oxygen.

References:
1. *ECS Transactions,* **2011**, *41*, 2, 147

98-4054
HAZ

Cyclopentadienylindium(I), elec. gr. (99.99+%-In) PURATREM, 97-3425, contained in 50 ml electropolished Swagelok® cylinder (96-1077) for CVD/ALD *(34822-89-4)*
C5H5In; FW: 179.92; off-white to light yellow xtl.; b.p. subl. 50°/0.01 mm
air sensitive, heat sensitive, light sensitive

5g

93-4923
HAZ

Indium (III) nitrate pentahydrate (99.999%-In) PURATREM *(13465-14-0)*
$In(NO_3)_3 \cdot XH_2O$; FW: 300.83 (390.83); white xtl.
hygroscopic

10g
50g

93-4936

Indium(III) acetate (99.99%-In) PURATREM *(25114-58-3)*
$In(OOCCH_3)_3$; FW: 291.95; white xtl.
moisture sensitive

5g
25g

93-4920

Indium(III) antimonide (99.99%-In) PURATREM *(1312-41-0)*
InSb; FW: 236.57; black xtl.; m.p. 535°; d. 5.76

5g
25g

93-4929

Indium(III) bromide, anhydrous (99.999%-In) PURATREM *(13465-09-3)*
$InBr_3$; FW: 354.55; white to light yellow pwdr.; m.p. ~436°; d. 4.74
hygroscopic

5g
25g

93-4930

Indium(I) chloride, anhydrous (99.99%-In) PURATREM *(13465-10-6)*
InCl; FW: 150.27; golden yellow pwdr.; m.p. ~225°; b.p. 608°; d. 4.19
air sensitive, moisture sensitive

2g
10g

93-4932

Indium(III) chloride, anhydrous (99.999%-In) PURATREM *(10025-82-8)*
$InCl_3$; FW: 221.18; white pwdr.; m.p. 586°; d. 3.46
hygroscopic

5g
25g
100g

93-4931

Indium(III) chloride tetrahydrate (99.99%-In) PURATREM *(22519-64-8)*
$InCl_3 \cdot 4H_2O$; FW: 221.18 (293.26); white xtl.

5g
25g
100g

93-4915

Indium(III) iodide (99.999%-In) PURATREM *(13510-35-5)*
InI_3; FW: 495.53; yellow to red solid; m.p. 210°; d. 4.69
hygroscopic

1g
5g
25g

INDIUM (Compounds)

93-4906	**Indium(III) oxide (99.998%-In) PURATREM** *(1312-43-2)* In_2O_3; FW: 277.64; yellow pwdr.; d. 7.179	5g 25g
93-4926	**Indium(III) phosphide (99.999%-In) PURATREM** *(22398-80-7)* InP; FW: 145.79; black xtl.; 1/4" pieces and down; m.p. 1070°	1g 5g
93-4927	**Indium(III) sulfate hydrate (99.999%-In) PURATREM** *(13464-82-9)* $In_2(SO_4)_3 \cdot XH_2O$; FW: 517.83; white xtl.	10g 50g
93-4911	**Indium(III) sulfide (99.99%-In) PURATREM** *(12030-24-9)* In_2S_3; FW: 325.83; orange pwdr.; m.p. 1050°; d. 4.45	5g 25g
98-2010 HAZ	**Trimethylindium, elec. gr. (99.999%-In) PURATREM** *(3385-78-2)* $(CH_3)_3In$; FW: 159.93; white xtl.; m.p. 88°; f.p. -1°F; d. 1.568 *heat sensitive, moisture sensitive, pyrophoric, (store cold)* Note: Available prepacked in ALD cylinder- see 98-4056.	25g 100g

WARNING - Trimethylindium may undergo rapid thermal decomposition if exposed to temperatures above 100ºC. Never attempt to distill the material at atmospheric pressure

98-4056 HAZ	**Trimethylindium, elec. gr. (99.999%-In) PURATREM, 98-2010, contained in 50 ml electropolished Swagelok® cylinder (96-1077) for CVD/ALD** *(3385-78-2)* $(CH_3)_3In$; FW: 159.93; white xtl.; m.p. 88°; f.p. -1°F; d. 1.568 *heat sensitive, moisture sensitive, pyrophoric, (store cold)*	25g

WARNING - Trimethylindium may undergo rapid thermal decomposition if exposed to temperatures above 100ºC. Never attempt to distill the material at atmospheric pressure

IRIDIUM (Compounds)

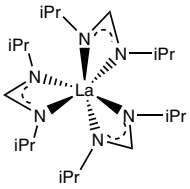
77-3010 NEW	**Iridium(III) chloride, hydrate (99.99+%-Ir) PURATREM** **[free of Ir(IV) by electrochemical analysis]** *(14996-61-3)* $IrCl_3 \cdot XH_2O$; FW: 298.58; black xtl. *hygroscopic*	250mg 1g 5g

IRON (Compounds)

26-2520 HAZ	**Iron 2-ethylhexanoate, 6% (Fe) in mineral spirits (99.998+%-Fe) PURATREM** *(7321-53-1)* $Fe[OOCCH(C_2H_5)C_4H_9]_3$; FW: 485.46; liq.	50g 250g
93-2672 HAZ	**Iron(III) nitrate nonahydrate (99.999%-Fe) PURATREM** *(7782-61-8)* $Fe(NO_3)_3 \cdot 9H_2O$; FW: 241.86 (404.02); colorless to pale violet xtl.; m.p. 47.2°; b.p. 125° dec.; d. 1.684 *hygroscopic*	5g 25g
26-2750	**Iron(III) oxide (99.995%-Fe) PURATREM** *(1309-37-1)* Fe_2O_3; FW: 159.69; red to brown pwdr.; m.p. 1565°	10g 50g

LANTHANUM (Compounds)

57-5731	**Lanthanum(III) chloride hydrate (99.999%-La) (REO) PURATREM** *(10025-84-0)* $LaCl_3 \cdot XH_2O$; FW: 245.27; white xtl.; m.p. 91° dec. *hygroscopic*	25g 100g
57-5730	**Lanthanum(III) chloride hydrate (99.999+%-La) (low Ca, Fe, Mg) PURATREM** *(10025-84-0)* $LaCl_3 \cdot XH_2O$; FW: 245.27; white xtl.; m.p. 91° dec. *hygroscopic*	25g 100g
57-2000	**Lanthanum(III) fluoride, anhydrous (99.99%-La) (REO) PURATREM** *(13709-38-1)* LaF_3; FW: 195.90; white lumps; m.p. 1493°; d. 5.936 *hygroscopic*	25g 100g
93-5732 HAZ	**Lanthanum(III) nitrate hexahydrate (99.99%-La) (REO) PURATREM** *(10277-43-7)* $La(NO_3)_3 \cdot 6H_2O$; FW: 324.93 (433.02); white xtl.; m.p. 40°; b.p. 126° dec. *hygroscopic*	25g 100g 500g
57-5732 HAZ	**Lanthanum(III) nitrate hexahydrate (99.999%-La) (REO) PURATREM** *(10277-43-7)* $La(NO_3)_3 \cdot 6H_2O$; FW: 324.93 (433.02); white xtl.; m.p. 40°; b.p. 126° dec.	25g 100g
93-5716	**Lanthanum(III) oxide (99.99%-La) (REO) PURATREM** *(1312-81-8)* La_2O_3; FW: 325.82; white pwdr.; m.p. 2315°; b.p. 4200°; d. 6.51	100g 500g
93-5741	**Lanthanum(III) oxide (99.999%-La) (REO) PURATREM** *(1312-81-8)* La_2O_3; FW: 325.82; white pwdr.; m.p. 2315°; b.p. 4200°; d. 6.51	25g 100g
57-1200 **NEW** amp HAZ	**Tris(N,N'-di-i-propylformamidinato)lanthanum(III), (99.999+%-La) PURATREM La-FMD** *(1034537-36-4)* $C_{21}H_{45}LaN_6$; FW: 520.53; white to off-white pwdr. *air sensitive, moisture sensitive* Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard2.	1g 5g



Technical Note:

1. Lanthanum precursor for the ALD/CVD of La_2O_3, $LaLuO_3$, $LaScO_3$, and $LaYO_3$ thin films.

References:

1. *Appl. Phys. Lett.,* **2009**, *94*, 262904
2. *Electrochem. Solid-State Lett.,* **2009**, *12*, G13
3. *Appl.Phys. Lett.,* **2010**, *97*, 162910
4. *J. Electrochem. Soc.,* **2011**, *158*, H447
5. *ECS Trans.,* **2012**, *45*, 95
6. *Nano Lett.,* **2013**, *13*, 594
7. *J. Crystal Growth,* **2013**, *363*, 150
8. *ECS Trans.,* **2013**, *54*, 255
9. *App. Surface Sci.,* **2014**, *292*, 880
10. *Proc. SPIE,* **2014**, *8987*, 898712

LEAD (Compounds)

82-0595 HAZ	**Lead(II) acetate trihydrate (99.999%-Pb) PURATREM** *(6080-56-4)* $Pb(OOCCH_3)_2 \cdot 3H_2O$; FW: 325.28 (379.33); white xtl.; m.p. 75° dec.; d. 2.55	25g 100g
82-0750 HAZ	**Lead(II) iodide (99.999+%-Pb) PURATREM** *(10101-63-0)* PbI_2; FW: 461.00; yellow pwdr.; m.p. 402°; b.p. 954°; d. 6.16	10g 50g
93-8267 HAZ	**Lead(II) nitrate (99.999%-Pb) PURATREM** *(10099-74-8)* $Pb(NO_3)_2$; FW: 331.20; white xtl.; m.p. 470° dec.; d. 4.53 *hygroscopic*	25g 100g
93-8219	**Lead(II) oxide (99.999+%-Pb) PURATREM** *(1317-36-8)* PbO; FW: 223.19; yellow pwdr.; m.p. 888°; d. 9.53	10g 50g
93-8257 HAZ	**Lead(II) selenide (99.99%-Pb) PURATREM** *(12069-00-0)* PbSe; FW: 286.15; gray to black pieces; m.p. 1065°; d. 8.10	5g 25g
93-8233	**Lead(II) sulfide (99.999%-Pb) PURATREM** *(1314-87-0)* PbS; FW: 239.25; black pwdr.; m.p. 1114°; d. 7.5	5g 25g

LITHIUM (Compounds)

93-0312	**Lithium carbonate (99.99%-Li) PURATREM** *(554-13-2)* Li_2CO_3; FW: 73.89; white pwdr.; m.p. 723°; b.p. 1310° dec.; d. 2.11	25g 100g
03-0800	**Lithium carbonate (99.999%-Li) PURATREM** *(554-13-2)* Li_2CO_3; FW: 73.89; white pwdr.; m.p. 723°; b.p. 1310° dec.; d. 2.11	25g 100g
03-0900	**Lithium chloride hydrate (99.996%-Li) PURATREM** *(16712-20-2)* $LiCl{\cdot}XH_2O$; FW: 42.39; white xtl.	10g 50g
93-0338	**Lithium niobate (99.998%-Nb) PURATREM** *(12031-63-9)* $LiNbO_3$; FW: 147.85; white pwdr.	25g 100g
93-0384	**Lithium tantalate (99.998%-Ta) PURATREM** *(12031-66-2)* $LiTaO_3$; FW: 235.89; white pwdr.	2g 10g
93-0365	**Lithium tetraborate (99.998%-Li) PURATREM** *(12007-60-2)* $Li_2B_4O_7$; FW: 169.12; white pwdr.; m.p. 917°	10g 50g

LUTETIUM (Compounds)

93-7115	**Lutetium(III) oxide (99.999%-Lu) (REO) PURATREM** *(12032-20-1)* Lu_2O_3; FW: 397.94; white pwdr.; m.p. 2487°; d. 9.41	1g 5g

MAGNESIUM (Compounds)

97-1040 amp HAZ	**Bis(cyclopentadienyl)magnesium (99.99+%-Mg) PURATREM** *(1284-72-6)* $(C_5H_5)_2Mg$; FW: 154.49; white to light pink xtl.; m.p. 176°; b.p. 290° (subl. 160°/0.1mm) *air sensitive, moisture sensitive*	1g 5g 25g
97-1045 amp HAZ	**Bis(pentamethylcyclopentadienyl)magnesium, elec. gr. (99.999%-Mg) PURATREM** *(74507-64-5)* $[(CH_3)_5C_5]_2Mg$; FW: 294.77; white to yellow xtl. *air sensitive, moisture sensitive*	1g 5g 25g
12-1100 HAZ	**Magnesium aluminum i-propoxide (99.99%-Mg) PURATREM** *(69207-83-6)* $MgAl_2(OC_3H_7)_8$; FW: 550.97; white xtl.; m.p. 40°; b.p. 110°/5 mm *moisture sensitive*	10g 50g
93-1226	**Magnesium fluoride (99.99+%-Mg) PURATREM** *(7783-40-6)* MgF_2; FW: 62.32; 1-4mm white pieces; m.p. 1248°; b.p. 2239°; d. 3.0	25g 100g
93-1237 HAZ	**Magnesium nitrate hexahydrate (99.999%-Mg) PURATREM** *(13446-18-9)* $Mg(NO_3)_2{\cdot}6H_2O$; FW: 148.32 (256.41); white xtl.; m.p. 89°; d. 1.64 *hygroscopic*	25g 100g
12-2025	**Magnesium oxide (99.99+%-Mg) PURATREM** *(1309-48-4)* MgO; FW: 40.31; white pwdr.; m.p. 2800°; b.p. 3600°; d. 3.58	5g 25g
12-1212	**Magnesium (N,N,N',N'-tetramethylethylenediamine)bis[BREW] (99.99+%-Mg) PURATREM** $Mg(C_6H_{16}N_2)[C_xH_yC(O)CHC(O)C_xH_y]_2$ (x=3-4, y=2x+1); pale yellow liq. *moisture sensitive* Note: ***Limited quantities available. Will discontinue when stock gone***	1g 5g

Technical Note:

1. See 56-5656 (page 2)

MANGANESE (Compounds)

25-0760	**Manganese(II) acetate tetrahydrate (99.999%-Mn) PURATREM** *(6156-78-1)* $Mn(CH_3COO)_2 \cdot 4H_2O$; FW: 173.02 (245.08); pale pink xtl.; d. 1.589	5g 25g
25-1345 NEW	**Manganese(II) chloride anhydrous (99.995%-Mn) PURATREM** *(7773-01-5)* $MnCl_2$; FW: 125.84; pink solid; m.p. 650°; b.p. 1190°; d. 2.98 *hygroscopic*	5g 25g 100g
25-1355	**Manganese(II) chloride tetrahydrate (99.995%-Mn) PURATREM** *(13446-34-9)* $MnCl_2 \cdot 4H_2O$; FW: 125.84 (197.91); rose xtl.; m.p. 58°; d. 2.01	5g 25g
25-1380 HAZ	**Manganese(IV) oxide (99.995%-Mn) PURATREM** *(1313-13-9)* MnO_2; FW: 86.94; black, random pieces; m.p. 535° dec.; d. 5.026	10g 50g

MERCURY (Compounds)

80-8008 amp HAZ	**Mercury(II) iodide, anhydrous (99.999%-Hg) PURATREM** *(7774-29-0)* HgI_2; FW: 454.45; orange to red pwdr.; m.p. 259°; b.p. 354°; d. 6.271	5g 25g
93-8013 HAZ	**Mercury(II) selenide (99.99%-Hg) PURATREM** *(20601-83-6)* HgSe; FW: 279.55; gray pwdr.	1g 5g 25g

MOLYBDENUM (Compounds)

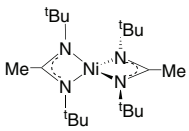
02-0750	**Ammonium molybdate tetrahydrate (99.999%-Mo) PURATREM** *(12027-67-7)* *See* page 1	
42-1000	**Ammonium tetrathiomolybdate(VI), 99% (99.99%-Mo) PURATREM** *(15060-55-6)* *See* page 2	
42-1475	**Molybdenum(VI) oxide (99.998%-Mo) PURATREM** *(1313-27-5)* MoO_3; FW: 143.95; pale green pwdr.; m.p. 795°; b.p. subl.; d. 4.69	10g 50g
42-1476	**Molybdenum(VI) oxide (99.999%-Mo) PURATREM** *(1313-27-5)* MoO_3; FW: 143.95; pale green pwdr.; m.p. 795°; b.p. subl.; d. 4.69	10g 50g

NEODYMIUM (Compounds)

60-6030	**Neodymium(III) chloride hydrate (99.997%-Nd) (REO) PURATREM** *(13477-89-9)* $NdCl_3 \cdot XH_2O$; FW: 250.60; purple xtl. *hygroscopic*	10g 50g
93-6024 HAZ	**Neodymium(III) nitrate hexahydrate (99.999%-Nd) (REO) PURATREM** *(16454-60-7)* $Nd(NO_3)_3 \cdot 6H_2O$; FW: 330.26 (438.35); purple xtl. *hygroscopic*	5g 25g
93-6009	**Neodymium(III) oxide (99.99+%-Nd) (REO) PURATREM** *(1313-97-9)* Nd_2O_3; FW: 336.48; blue pwdr.; m.p. 2272°; d. 7.24	5g 25g

NICKEL (Compounds)

28-0045 amp	**Bis(N,N'-di-t-butylacetamidinato)nickel(II), (99.999%-Ni) PURATREM** *(940895-79-4)* $C_{20}H_{42}N_4Ni$; FW: 397.27; dark, purple-black xtl.; m.p. 95-96° *air sensitive, moisture sensitive* Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard2.	250mg 1g 5g



Technical Notes:

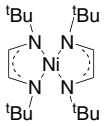
1. CVD/ALD precursor for the preparation of nickel nitride (NiNx) films.
2. CVD/ALD precursor for the preparation of nickel sulfide (NiSx) films co-deposited by H_2S.

References:

1. *Chem. Mater.,* **2010**, *22*, 3060
2. *Chem. Mater.,* **2016**, *28*, 1155.

NICKEL (Compounds)

28-0225 NEW
Bis(1,4-di-t-butyl-1,3-diazabutadienyl)nickel(II) Ni(DAD)2, min. 98% (99.999%-Ni) PURATREM
$C_{20}H_{40}N_4Ni$; FW: 395.25; dichroic red/green xtl
air sensitive
Note: U.S. Patent Application No. 13/818,154. Product sold under, use subject to, terms and conditions of label license at www.strem.com/waynestate1



250mg
1g
5g

28-1100
Nickel(II) acetate tetrahydrate (99.999%-Ni) PURATREM *(6018-89-9)*
$Ni(OOCCH_3)_2 \cdot 4H_2O$; FW: 176.80 (248.86); green xtl.; m.p. dec.; d. 1.744
5g
25g

28-1160
HAZ
Nickel(II) chloride hexahydrate (99.999+%-Ni) PURATREM *(7791-20-0)*
$NiCl_2 \cdot 6H_2O$; FW: 129.62 (237.70); green xtl.
10g
50g

28-1440
HAZ
Nickel(II) nitrate hexahydrate (99.9985%-Ni) PURATREM *(13478-00-7)*
$Ni(NO_3)_2 \cdot 6H_2O$; FW: 182.72 (290.81); green xtl.; m.p. 56.7°; d. 2.05
25g
100g

28-1470
Nickel(II) oxalate dihydrate (99.998%-Ni) PURATREM *(6018-94-6)*
$NiC_2O_4 \cdot 2H_2O$; FW: 146.73 (182.76); light green pwdr.
10g
50g

93-2833
Nickel(II) oxide (99.99%-Ni) PURATREM *(1313-99-1)*
NiO; FW: 74.71; green pwdr.; m.p. 1990°; d. 6.67
25g
100g

28-1475
Nickel(II) oxide (99.998%-Ni) PURATREM *(1313-99-1)*
NiO; FW: 74.71; greenish-black pwdr.; m.p. 1990°; d. 6.67
10g
50g

93-2856
Nickel(II) sulfate hexahydrate (99.99%-Ni) PURATREM *(10101-97-0)*
$NiSO_4 \cdot 6H_2O$; FW: 154.78 (262.86); green xtl.; d. 2.07
25g
100g

NIOBIUM (Compounds)

41-1250
HAZ
Niobium(V) chloride (99.99%-Nb) (20-200ppm Ta) PURATREM *(10026-12-7)*
$NbCl_5$; FW: 270.17; yellow xtl.; m.p. 204-206°; b.p. 254°; d. 2.75
moisture sensitive
5g
25g
100g

41-5200
Niobium(V) oxide (99.995%-Nb) (50-100ppm Ta) PURATREM *(1313-96-8)*
Nb_2O_5; FW: 265.82; white pwdr.; m.p. 1520°; d. 4.47
25g
100g

OSMIUM (Compounds)

76-2958
amp
HAZ
Osmium(VIII) oxide (99.99+%-Os) PURATREM *(20816-12-0)*
OsO_4; FW: 254.20; pale yellow xtl.; m.p. 41-42°; d. 4.906
250mg
500mg
1g
5x1g

76-2955
amp
HAZ
Osmium(VIII) oxide (99.99+%-Os), 4% in water PURATREM *(20816-12-0)*
OsO_4; FW: 254.20; colorless liq.
2ml
5ml
2x5ml

OXYGEN (Compounds)

98-8000 NEW
Water, 99.999% (PURATREM), 98-0295, contained in 50 ml Swagelok® cylinder (96-1070) for CVD/ALD *(7732-18-5)*
H_2O; FW: 18.015; colorless liq.; m.p. 0; b.p. 100; d. 1.0
25g

PALLADIUM (Elemental Forms)

93-4630
HAZ
Palladium powder (99.999%) PURATREM *(7440-05-3)*
Pd; FW: 106.40; -22 mesh; m.p. 1552°; b.p. 3140°; d. 12.02
1g
5g

PALLADIUM (Compounds)

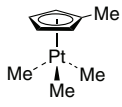
02-1275
Ammonium tetrachloropalladate(II) (99.998%-Pd) PURATREM *(13820-40-1)*
See page 2

PHOSPHORUS (Compounds)

93-1588 amp HAZ	**Phosphorus(III) chloride (99.998%-P) PURATREM** *(7719-12-2)* PCl_3; FW: 137.33; m.p. -111.8°; b.p. 76°; d. 1.574 *moisture sensitive*	10g 50g
93-1592 HAZ	**Phosphorus(V) oxide (99.99%-P) PURATREM** *(1314-56-3)* P_2O_5; FW: 141.95; white pwdr.; m.p. 580-585°; b.p. 300° subl.; d. 2.39 *hygroscopic*	50g 250g
97-8875 amp HAZ	**Phosphorus oxychloride, elec. gr. (99.999%-P) PURATREM** *(10025-87-3)* $POCl_3$; FW: 153.35; colorless liq.; m.p. 2°; b.p. 105.3°; d. 1.675 *moisture sensitive*	25g 100g

PLATINUM (Compounds)

98-1350 NEW	**(Trimethyl)methylcyclopentadienylplatinum(IV), 99% (99.999%-Pt) PURATREM** *(94442-22-5)* $(CH_3)_3(CH_3C_5H_4)Pt$; FW: 319.32; off-white pwdr.; m.p. 30-31°; b.p. (subl. 23°C/0.053mm); d. 1.88 *air sensitive, (store cold)*	500mg 2g 10g



POTASSIUM (Compounds)

93-1962	**Potassium bromide (99.999%-K) PURATREM** *(7758-02-3)* KBr; FW: 119.01; white xtl.; m.p. 730°; b.p. 1435°; d. 2.75 *hygroscopic*	10g 50g
19-2600	**Potassium carbonate (99.997%-K) PURATREM** *(584-08-7)* K_2CO_3; FW: 138.21; white pwdr.; m.p. 891°; b.p. dec.; d. 2.428 *hygroscopic*	10g 50g
93-1977	**Potassium chloride, 99+% (99.99+%-K) optical grade PURATREM** *(7447-40-7)* KCl; FW: 74.56; white xtl.; m.p. 776°; b.p. 1500° subl.; d. 1.984	10g 50g
93-1978	**Potassium chloride (99.999%-K) PURATREM** *(7447-40-7)* KCl; FW: 74.56; white xtl.; m.p. 776°; b.p. 1500° subl.; d. 1.984	25g 100g
93-1930	**Potassium iodide (99.99%-K) PURATREM** *(7681-11-0)* KI; FW: 166.01; white pwdr.; m.p. 686°; b.p. 1330°; d. 3.13 *hygroscopic*	10g 50g
93-4117	**Potassium niobate (99.999%-Nb) PURATREM** *(12030-85-2)* $KNbO_3$; FW: 180.01; white pwdr.	10g 50g
19-5400 HAZ	**Potassium nitrate (99.999%-K) PURATREM** *(7757-79-1)* KNO_3; FW: 101.11; white xtl.; m.p. 334°; b.p. 400° dec.; d. 2.109	25g 100g
19-4000	**Potassium sulfate (99.999%-K) PURATREM** *(7778-80-5)* K_2SO_4; FW: 174.27; white xtl.	2g 10g 50g
93-7906	**Potassium tetrachloroaurate(III) hydrate (99.99%-Au) (51%-Au) PURATREM** *(13682-61-6)* $KAuCl_4 \cdot XH_2O$; FW: 377.88; yellow to orange xtl.	1g 5g

PRASEODYMIUM (Compounds)

93-5910	**Praseodymium(III,IV) oxide (99.99%-Pr) (REO) PURATREM** *(12037-29-5)* Pr_6O_{11}; FW: 1021.43; black pwdr.	1g 5g 25g

RHENIUM (Elemental Forms)

75-1890 HAZ	**Rhenium powder (99.99%) PURATREM** *(7440-15-5)* Re; FW: 186.20; -325 mesh pwdr.; SA: high; m.p. 3180°; b.p. 5900°; d. 21.04	1g 5g

RHENIUM (Compounds)

02-0900 **Ammonium perrhenate (99.999%-Re) PURATREM** *(13598-65-7)*
See page 1

93-7501 HAZ
Perrhenic acid, aqueous solution (50-54% Re) (99.99%-Re) PURATREM 2g
(13768-11-1) 10g
$HReO_4$; FW: 251.26; colorless liq. 50g

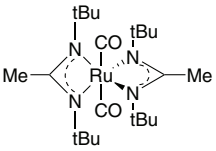
93-7505 HAZ
Rhenium(VII) oxide (99.99%-Re) PURATREM *(1314-68-7)* 1g
Re_2O_7; FW: 484.40; yellow to pale green pwdr.; m.p. ~297°; b.p. 250° subl.; d. 6.103 5g
hygroscopic

RHODIUM (Compounds)

02-0590 **Ammonium hexachlororhodate(III) monohydrate (99.995%-Rh) PURATREM** *(15336-18-2)*
See page 1

RUTHENIUM (Compounds)

44-0056 NEW amp
Bis(N,N'-di-tert-butylacetamidinato)ruthenium(II) dicarbonyl, 98% (99.99%-Ru) PURATREM *(949113-49-9)* 1g
$C_{22}H_{42}N_4O_2Ru$; FW: 495.67; Beige to yellow solid; m.p. 204 5g
air sensitive, moisture sensitive
Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard2



44-5885 NEW HAZ
Ruthenium(III) chloride hydrate (40-43% Ru) (99.99+%-Ru) PURATREM [free of Ru(II) and Ru(IV) by electrochemical analysis] 1g
(14898-67-0) 5g
$RuCl_3 \cdot XH_2O$; FW: 207.43; black pwdr.
hygroscopic

SAMARIUM (Compounds)

93-6231 **Samarium(III) oxide (99.99+%-Sm) (REO) PURATREM** *(12060-58-1)* 5g
Sm_2O_3; FW: 348.70; white to off-white pwdr.; d. 8.347 25g

SCANDIUM (Compounds)

93-2110 **Scandium(III) carbonate hydrate (99.99%-Sc) (REO) PURATREM** *(5809-49-4)* 1g
$Sc_2(CO_3)_3 \cdot XH_2O$; FW: 269.96; white pwdr. 5g

93-2102 **Scandium (III) chloride, anhydrous (99.99%-Sc) (REO), sublimed, PURATREM** 250mg
(10361-84-9) 1g
$ScCl_3$; FW: 151.32; white pwdr.; m.p. 939°; d. 2.39 5g
hygroscopic

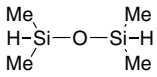
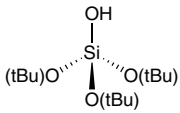
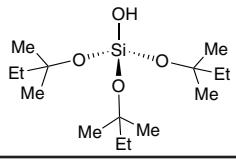
21-2112 **Scandium(III) oxide (99.99%-Sc) (REO) PURATREM** *(12060-08-1)* 1g
Sc_2O_3; FW: 137.91; white pwdr. (~7 micron); d. 3.864 5g
25g

SELENIUM (Compounds)

93-3405 HAZ
Selenium(IV) oxide (99.999%-Se) PURATREM *(7446-08-4)* 5g
SeO_2; FW: 110.96; off-white pwdr.; b.p. 340-350° subl.; d. 3.95 25g

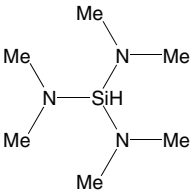
34-0100 HAZ
Selenous acid (99.999%-Se) PURATREM *(7783-00-8)* 25g
H_2SeO_3; FW: 128.97; white xtl.; m.p. 70° dec.; d. 3.004 100g
hygroscopic

SILICON (Compounds)

14-1072 NEW	**Bis(t-butylamino)silane, BTBAS (99.999%-Si) PURATREM** *(186598-40-3)* $C_8H_{22}N_2Si$; FW: 174.36; colorless liq.; b.p. 167°C; f.p. 30°C; d. 0.816 *moisture sensitive*	1g 5g 25g
98-8810 NEW HAZ	**Bis(diethylamino)silane, 99% (99.999%-Si) BDEAS PURATREM** *(27804-64-4)* $SiH_2[N(CH_2CH_3)_2]_2$; FW: 174.36; colorless liq. *air sensitive, moisture sensitive*	5g 25g
14-1955 NEW HAZ	**Hexakis(ethylamino)disilane (99.995%-Si) PURATREM** *(532980-53-3)* $(C_2H_5NH)_6Si_2$; FW: 320.63; colorless liq.; m.p. -7°; b.p. 257°; d. 1.0 *moisture sensitive*	1g 5g
14-1445 NEW HAZ	**Silicon(IV) bromide, (99.99% Si) PURATREM** *(7789-66-4)* $SiBr_4$; FW: 347.72; colorless liq.; m.p. 5.4º; b.p. 154º; d. 2.772 *moisture sensitive*	5g 25g
98-0147 HAZ	**Silicon(IV) chloride, fiber optic grade (99.9999%-Si, 50ppm-Fe) PURATREM** *(10026-04-7)* $SiCl_4$; FW: 169.90; colorless liq.; m.p. -70°; b.p. 57.6°; d. 1.483 *moisture sensitive* Note: Available prepacked in ALD cylinder- see 98-4027.	100g 500g
98-4027 HAZ	**Silicon(IV) chloride, fiber optic grade (99.9999%-Si, 50ppm-Fe) PURATREM, 98-0147, contained in a 50 ml electropolished Swagelok® cylinder (96-1077) for CVD/ALD** *(10026-04-7)* $SiCl_4$; FW: 169.90; colorless liq.; m.p. -70°; b.p. 57.6°; d. 1.483 *moisture sensitive*	50g
14-7423 NEW	**Silicon nitride, 0.2-2.5 microns (99.99%-Si) PURATREM** *(12033-89-5)* Si_3N_4; FW: 140.28; light gray pwdr.	50g 250g
98-0145	**Silicon(IV) oxide, elec. gr. (99.999%-Si) PURATREM** *(7631-86-9)* SiO_2; FW: 60.09; white pwdr.; m.p. 1500°; d. 2.6	5g 25g 100g
14-7025 NEW HAZ	**1,1,3,3-Tetramethyldisiloxane, 99+% TMDSO (99.9999%-Si) PURATREM** *(3277-26-7)* $C_4H_{14}OSi_2$; FW: 134.32; colorless liq.; b.p. 70-71°; f.p. -26°C; d. 0.76 *moisture sensitive* 	25g 100g
14-7015	**Tri-t-butoxysilanol (99.999%-Si) PURATREM** *(18166-43-3)* $[(CH_3)_3CO]_3SiOH$; FW: 264.43; white liquid to semi-solid; m.p. 63-65° *moisture sensitive* Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard1. Available prepacked in ALD cylinder- see 98-6025. 	1g 5g
98-6025	**Tri-t-butoxysilanol (99.999%-Si) PURATREM 14-7015 contained in 50 ml Swagelok® cylinder (96-1077) for CVD/ALD** *(18166-43-3)* $[(CH_3)_3CO]_3SiOH$; FW: 264.43; white solid *moisture sensitive* Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard1.	25g
14-7020	**Tri-t-pentoxysilanol (99.999%-Si) PURATREM** *(17906-35-3)* $[CH_3CH_2C(CH_3)_2O]_3SiOH$; FW: 306.51; colorless liq. *moisture sensitive* Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard1. ***Limited quantities available.*** 	1g 5g

SILICON (Compounds)

14-8750 HAZ — **Tris(dimethylamino)silane, 99+%, 3DMAS (99.999%-Si) PURATREM** *(15112-89-7)* — 5g, 25g
$[(CH_3)_2N]_3SiH$; FW: 161.32; colorless to light yellow liq.; b.p. 145-148° (4°/16mm); f.p. 77°F; d. 0.84
Note: Available prepacked in ALD cylinder- see 98-4035.



Technical Note:
1. Silicon precursor for the atomic layer deposition (ALD) and CVD of silicon containing thin films.

References:

1. *Nanoscale Research Letters*, **2017**, *12*, 370.
2. *Journal of the Korean Physical Society*, **2015**, *67(12)*, 2115-2119.
3. *Journal of Materials Science: Materials in Electronics*, **2012**, *23*, 2075.

98-4035 HAZ — **Tris(dimethylamino)silane, 99+%, 3DMAS (99.999%-Si) PURATREM 14-8750, contained in 50 ml Swagelok® cylinder (96-1070) for CVD/ALD** *(15112-89-7)* — 25g
$[(CH_3)_2N]_3SiH$; FW: 161.32; colorless to light yellow liq.; b.p. 145-148° (4°/16mm); f.p. 77°F; d. 0.84
air sensitive, moisture sensitive

SILVER (Compounds)

47-1325 HAZ — **Silver nitrate (99.9995%-Ag) PURATREM** *(7761-88-8)* — 10g, 50g
$AgNO_3$; FW: 169.87; white xtl.; m.p. 212°; b.p. 444° dec.; d. 4.352

93-4743 HAZ — **Silver(I) oxide, 99+% (99.99%-Ag) PURATREM** *(20667-12-3)* — 10g, 50g
Ag_2O; FW: 231.74; black pwdr.; m.p. 300° dec.; d. 7.143

47-1700 HAZ — **Silver perrhenate, 99% (99.995+%-Re) PURATREM** *(20654-56-2)* — 1g, 5g
$AgReO_4$; FW: 358.07; white pwdr.; m.p. 430°; d. 7.05

93-4733 — **Silver telluride (99.99%-Ag/Te) PURATREM** *(12002-99-2)* — 1g, 5g
Ag_2Te; FW: 343.34; black xtl.; m.p. 955°; d. 8.5

SODIUM (Compounds)

93-1121 — **Sodium bromide (99.999%-Na) PURATREM** *(7647-15-6)* — 10g, 50g
NaBr; FW: 102.90; white xtl.; m.p. 755°; b.p. 1390°; d. 3.203
hygroscopic

11-1100 — **Sodium chloride (99.999%-Na) PURATREM** *(7647-14-5)* — 10g, 50g, 250g
NaCl; FW: 58.44; white xtl.; m.p. 801°; b.p. 1413°; d. 2.165

11-2000 HAZ — **Sodium fluoride (99.99+%-Na) PURATREM** *(7681-49-4)* — 25g, 100g
NaF; FW: 41.99; white pwdr.; m.p. 988°; b.p. 1695°; d. 2.558

11-1146 NEW — **Sodium hexafluorophosphate 99% (99.99%-Na) PURATREM** *(21324-39-0)* — 2g, 10g
F_6NaP; FW: 167.95; white pwdr.; d. 2.37
air sensitive, moisture sensitive, hygroscopic

11-1147 NEW HAZ — **Sodium hexafluorophosphate 99% (99.99%-Na) PURATREM (<10ppm H2O)** *(21324-39-0)* — 1g, 5g
F_6NaP; FW: 167.95; white pwdr.
air sensitive, moisture sensitive, hygroscopic
Note: Suitable for battery applications

93-1064 HAZ — **Sodium hydroxide monohydrate (99.99%-Na) PURATREM** *(12179-02-1)* — 10g, 50g
$NaOH \cdot H_2O$; FW: 40.00 (58.01); white xtl.
hygroscopic

93-1069 — **Sodium sulfate, anhydrous (99.999%-Na) PURATREM** *(7757-82-6)* — 10g, 50g
Na_2SO_4; FW: 142.04; white pwdr.; m.p. 888°; d. 2.68

93-1072 — **Sodium tetraborate, anhydrous (99.998%-B) (50 ppm K) PURATREM** *(1330-43-4)* — 10g, 50g
$Na_2B_4O_7$; FW: 201.22; white pwdr.; m.p. 741°; b.p. 1575° dec.; d. 2.367

STRONTIUM (Compounds)

38-1010 **Bis(2,2,6,6-tetramethyl-3,5-heptanedionato)strontium tetraglyme adduct** 1g
(99.99%-Sr) PURATREM *(150939-76-7)* 5g
$Sr(C_{11}H_{19}O_2)_2{\cdot}CH_3(OCH_2CH_2)_4OCH_3$; FW: 454.16 (676.44); white xtl.; m.p. 75°
Note: This compound is covered by U.S. Patent No. 5,225,561, and is manufactured and sold under license from Advanced Technology Materials, Inc., Danbury, CT.

38-1015 **Bis(2,2,6,6-tetramethyl-3,5-heptanedionato)strontium triglyme adduct** 1g
(99.99%-Sr) PURATREM 5g
$Sr(C_{11}H_{19}O_2)_2{\cdot}CH_3(OCH_2CH_2)_3OCH_3$; FW: 454.16 (632.39); white xtl.; m.p. 102°
Note: This compound is covered by U.S. Patent No. 5,225,561, and is manufactured and sold under license from Advanced Technology Materials, Inc., Danbury, CT.

38-3838 **Strontium bis(N,N,N',N',N''-pentamethyldiethylenetriamine)bis[BREW] (99.99+%-Sr)** 1g
PURATREM 5g
$Sr(C_9H_{23}N_3)_2[C{\cdot}HyC(O)CHC(O)C{\cdot}Hy]_2$ (x=3-4, y=2x +1); pale yellow liq.
moisture sensitive
Note: 9-11 wt% Sr, ***Limited quantities available. Will discontinue when stock gone***

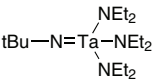
Technical Note:
1. See 56-5656 (page 2)

38-1100 **Strontium carbonate (99.995%-Sr) PURATREM** *(1633-05-2)* 10g
$SrCO_3$; FW: 147.63; white pwdr.; m.p. 1497°; d. 3.70 50g

93-3843 **Strontium fluoride (99.99%-Sr) PURATREM** *(7783-48-4)* 10g
SrF_2; FW: 125.62; white pwdr.; m.p. > 1450°; b.p. 2489°; d. 4.24 50g
hygroscopic

TANTALUM (Compounds)

73-0723 **(t-Butylimido)tris(diethylamino)tantalum(V), min. 98%** 250mg
(99.99%-Ta) PURATREM TBTDET *(169896-41-7)* 1g
$C_{16}H_{39}N_4Ta$; FW: 468.45; colorless to pale yellow liq.; 5g
d. 1.252 g/ml@25°C
air sensitive, moisture sensitive

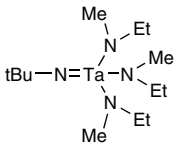


Technical Note:
1. Useful precursor for the atomic layer deposition of tantalum oxide and tantalum nitride.

References:

1. *Journal of Nanosci. and Nanotechno.,* **2013**, *13*, 4097.
2. *Semicond. Sci. Tech.,* **2012**, *27*, 074003/1.
3. *Chem. Vapor Depos.*, **2011**, *17*, 37.
4. *Electrochem. Solid St.,* **2010**, *13*, H426.
5. *J. Electrochem. Soc.,* **2010**, *157*, H652.
6. *J. Electrochem. Soc.,* **2009**, *156*, H852.

73-0735 **(t-Butylimido)tris(ethylmethylamino)tantalum(V)** 1g
NEW **(99.99%-Ta) PURATREM** *(511292-99-2)* 5g
$C_{13}H_{33}N_4Ta$; FW: 426.38; yellow liq. 25g
air sensitive, moisture sensitive



73-0950 **Tantalum(V) n-butoxide (99.99+%-Ta) PURATREM** *(51094-78-1)* 5g
HAZ $C_{20}H_{45}O_5Ta$; FW: 546.52; colorless to light yellow liq.; d. 1.31 25g
air sensitive, moisture sensitive

Technical Notes:
1. Precursor used for the sol-gel deposition of $NaTaO_3$ thin films.
2. Precursor used for the sol-gel deposition of Tantalum doped TiO_2.
3. Used for the synthesis of Tantalum oxide nanoparticles.

References:

1. *RSC Advances*, **2012**, *2*, 5130.
2. *J. Mat. Res.*, **2011**, *26*, 2653.
3. *Journal of Solid State Chemistry*, **2013**, *199*, 15 – 20.

TANTALUM (Compounds)

93-7324 — **Tantalum(V) chloride, resublimed (99.99+%-Ta) PURATREM** *(7721-01-9)* — 10g, 50g
amp
HAZ
$TaCl_5$; FW: 358.21; white pwdr.; m.p. 216° (subl. 144°); b.p. 242°; d. 3.68
moisture sensitive

93-7303 — **Tantalum(V) ethoxide (99.99+%-Ta) PURATREM** *(6074-84-6)* — 10g, 50g, 5 x 50g
amp
HAZ
$Ta(OC_2H_5)_5$; FW: 406.26; colorless to yellow liq.; m.p. 21°; b.p. 145°/0.1 mm; f.p. 87°F; d. 1.56
moisture sensitive

73-1080 — **Tantalum(V) ethoxide (99.9999%-Ta) PURATREM** *(6074-84-6)* — 1g
amp
HAZ
$Ta(OC_2H_5)_5$; FW: 406.26; yellow liq.; m.p. 21°; b.p. 145°/0.1mm; f.p. 87°F; d. 1.56
moisture sensitive
Note: Limited quantities available.

93-7329 — **Tantalum(V) methoxide (99.99+%-Ta) PURATREM** *(865-35-0)* — 2g, 10g
HAZ
$Ta(OCH_3)_5$; FW: 336.12; white pwdr.; m.p. 50°; b.p. 189°/10 mm
moisture sensitive

93-7306 — **Tantalum(V) oxide, 99.8% (99.99+%-Ta) PURATREM** *(1314-61-0)* — 10g, 50g
Ta_2O_5; FW: 441.89; white pwdr.; m.p. 1800°; d. 8.2

73-5000 — **Tantalum(V) (tetraethoxy)(acetylacetonate) (99.99+%-Ta) PURATREM** — 10g, 50g
HAZ
(20219-33-4)
$Ta(OC_2H_5)_4(CH_3COCHCOCH_3)$; FW: 460.30; yellow solid; m.p. 45°; b.p. 95°/0.5mm; d. 1.5
moisture sensitive

73-7373 — **Tantalum(V) (tetraethoxy)[BREW] (99.99+%-Ta) PURATREM** — 1g, 5g
$Ta(C_2H_5O)_4[C_xH_yC(O)CHC(O)C_xH_y]_2$ (x=3-4, y=2x+1); pale brown liq.
moisture sensitive
Note: ***Limited quantities available. Will discontinue when stock gone***

TELLURIUM (Compounds)

93-5216 — **Tellurium(IV) oxide (99.999%-Te) PURATREM** *(7446-07-3)* — 10g, 50g
TeO_2; FW: 159.60; off-white pwdr.; m.p. 733°; b.p. 450° subl.

TERBIUM (Compounds)

65-6502 — **Terbium(III) chloride hydrate (99.995%-Tb) (REO) PURATREM** *(13798-24-8)* — 5g, 25g
$TbCl_3 \cdot XH_2O$; FW: 265.29; white xtl.

THALLIUM (Compounds)

93-8103 — **Thallium(I) bromide (99.999%-Tl) PURATREM** *(7789-40-4)* — 10g, 50g
HAZ
TlBr; FW: 284.28; yellow pwdr.; m.p. 480°; b.p. 815°; d. 7.557

93-8108 — **Thallium(I) iodide (99.999%-Tl) PURATREM** *(7790-30-9)* — 5g, 25g
HAZ
TlI; FW: 331.27; yellow pwdr.; m.p. 440°; b.p. 823°; d. 7.09

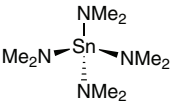
81-6750 — **Thallium(I) nitrate (99.99%-Tl) PURATREM** *(10102-45-1)* — 10g, 50g, 250g
HAZ
$TlNO_3$; FW: 266.37; white xtl.; m.p. 206°; b.p. 430°

81-8100 — **Thallium(III) oxide (99.99%-Tl) PURATREM** *(1314-32-5)* — 10g, 50g
HAZ
Tl_2O_3; FW: 456.74; black pwdr.; m.p. ~717°

81-8200 — **Thallium(I) sulfate (99.999%-Tl) PURATREM** *(7446-18-6)* — 5g, 25g
HAZ
Tl_2SO_4; FW: 504.80; white xtl.; m.p. 632°; b.p. dec.; d. 6.77

TIN (Compounds)

50-1815 — **Tetrakis(dimethylamino)tin(IV), 99% (99.99%-Sn) TDMASn PURATREM** *(1066-77-9)* — 1g, 5g, 25g
amp
HAZ
$Sn[N(CH_3)_2]_4$; FW: 295.01; colorless to pale-yellow liq.; b.p. 51° (0.1mm); d. 1.169 g/cm³
moisture sensitive
Note: Available prepacked in ALD cylinder- see 98-4050.



Technical Note:
1. ALD precursor for tin.

References:
1. *Chem. Mater.,* **1992**, *4*, 68
2. *Chem. Mater.,* **1994**, *6*, 360
3. *Chem. Mater.,* **2014**, *26*, 2795

TIN (Compounds)

98-4050 HAZ	**Tetrakis(dimethylamino)tin(IV), 99% (99.99%-Sn) TDMASn PURATREM, 50-1815, contained in 50 ml Swagelok® cylinder (96-1070) for CVD/ALD** *(1066-77-9)* $Sn[N(CH_3)_2]_4$; FW: 295.01; colorless to pale-yellow liq.; b.p. 51° (0.1mm); d. 1.169g/cm^3 *moisture sensitive*	10g 25g
50-2100	**Tin(IV) t-butoxide (99.99%-Sn) PURATREM** *(36809-75-3)* $Sn(OC_4H_9)_4$; FW: 411.17; white solid to turbid colorless liq.; m.p. 45°; b.p. 65°/0.3mm; d. 1.06 *moisture sensitive*	1g 5g 25g
50-5022 NEW HAZ	**Tin(IV) chloride, anhydrous (99.99-Sn%) PURATREM** *(7646-78-8)* $SnCl_4$; FW: 260.50; colorless liq.; m.p. -33°; b.p. 114.1°C; d. 2.226 *air sensitive, moisture sensitive*	5g 25g
50-2500	**Tin(IV) oxide (99.998%-Sn) PURATREM** *(18282-10-5)* SnO_2; FW: 150.69; -22 mesh off-white pwdr.; m.p. 1630°; d. 7.0	5g 25g

TITANIUM (Compounds)

22-2240 NEW HAZ	**Tetrakis(dimethylamino)titanium(IV), 99% TDMAT (99.99%-Ti) PURATREM** *(3275-24-9)* $Ti[N(CH_3)_2]_4$; FW: 224.20; yellow to orange liq.; f.p. -22°F *air sensitive, moisture sensitive*	1g 5g 25g
22-1060 NEW amp HAZ	**Tetrakis(ethylmethylamino)titanium, 99% (99.99%-Ti) PURATREM** *(308103-54-0)* $C_{12}H_{32}N_4Ti$; FW: 280.28; yellow to orange liq.; b.p. 80°/1 mm *moisture sensitive*	2g 10g
22-2222	**Titanium(IV) (di-i-propoxide)bis[BREW] (99.99+%-Ti) PURATREM** $Ti(OC_3H_7)_2[C_xH_yC(O)CHC(O)C_xH_y]_2$ (x=3-4, y=2x + 1); red-orange liq. *moisture sensitive* Note: 8-11 wt% Ti, ***Limited quantities available. Will discontinue when stock gone***	1g 5g
22-2209 amp HAZ	**Titanium(IV) ethoxide (99.99%-Ti) PURATREM** *(3087-36-3)* $Ti(OC_2H_5)_4$; FW: 228.14; xtl. to pale orange liq.; m.p. 54°; b.p. 138°/5mm; f.p. 84°F; d. 1.088 *moisture sensitive*	5g 25g
93-2223 HAZ	**Titanium(IV) iodide (99.99%-Ti) PURATREM** *(7720-83-4)* TiI_4; FW: 555.52; black xtl.; m.p. 150°; b.p. 377.1°; d. 4.3 *moisture sensitive*	1g 5g
93-2207	**Titanium(IV) oxide (99.99+%-Ti) PURATREM** *(13463-67-7)* TiO_2; FW: 79.90; white pwdr.; m.p. 1830-1850°; b.p. 2500-3000°; d. 4.26	25g 100g
22-1155 NEW HAZ	**Titanium(IV) chloride, (99.99+%-Ti) PURATREM** *(7550-45-0)* $TiCl_4$; FW: 189.73; pale yelloq liq.; m.p. -25; b.p. 136; d. 1.726 *air sensitive, moisture sensitive*	50g

TUNGSTEN (Compounds)

74-3105	**Tungsten(VI) oxide (99.995%-W) PURATREM** *(1314-35-8)* WO_3; FW: 231.85; yellow pwdr.; m.p. 1473°; d. 7.16	10g 50g
93-7411	**Tungsten(VI) oxide, sintered lumps (99.99%-W) PURATREM** *(1314-35-8)* WO_3; FW: 231.85; yellowish-green pieces; m.p. 1473°; d. 7.16	10g 50g

VANADIUM (Compounds)

93-2337 HAZ	**Vanadium(V) oxide (99.99%-V) PURATREM** *(1314-62-1)* V_2O_5; FW: 181.88; -22 mesh orange pwdr.; m.p. 690°; b.p. 1750° dec.; d. 3.357	5g 25g

YTTERBIUM (Compounds)

70-7003	**Ytterbium(III) chloride hydrate (99.99+%-Yb) (REO) PURATREM** *(19423-87-1)* $YbCl_3 \cdot XH_2O$; FW: 279.40; white xtl.; d. 2.575	5g 25g
70-7004	**Ytterbium(III) fluoride (99.99%-Yb) (REO) PURATREM** *(13760-80-0)* YbF_3; FW: 230.04; white pwdr.; m.p. 1157°; b.p. 2200°; d. 8.168 *hygroscopic*	5g 25g

YTTRIUM (Compounds)

39-2940 HAZ	**Yttrium(III) nitrate hexahydrate (99.999%-Y) (REO) PURATREM** *(13494-98-9)* $Y(NO_3)_3 \cdot 6H_2O$; FW: 274.92 (383.01); white xtl.	25g 100g
93-3910	**Yttrium(III) oxide (99.99%-Y) (REO) PURATREM** *(1314-36-9)* Y_2O_3; FW: 225.81; white pwdr.; m.p. 2410°; d. 5.01	50g 250g
93-3925	**Yttrium(III) oxide (99.999%-Y) (REO) PURATREM** *(1314-36-9)* Y_2O_3; FW: 225.81; white pwdr.; m.p. 2410°; d. 5.01	10g 50g 1kg
39-2980	**Yttrium(III) phosphate hydrate (99.99%-Y) (REO) PURATREM** *(34054-55-2)* $YPO_4 \cdot XH_2O$; FW: 183.88; white pwdr.	5g 25g

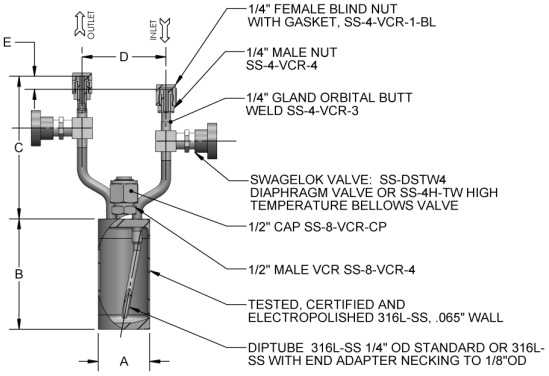
ZINC (Compounds)

97-4525 HAZ	**Diethylzinc, elec. gr. (99.9998%-Zn) PURATREM** *(557-20-0)* $Zn(C_2H_5)_2$; FW: 123.49; colorless liq.; m.p. -28°; b.p. 124°; f.p. -1°F; d. 1.18 *moisture sensitive, pyrophoric*	100g
97-5060 HAZ	**Dimethylzinc, elec. gr. (99.999%-Zn) PURATREM** *(544-97-8)* $Zn(CH_3)_2$; FW: 95.44; colorless liq.; m.p. -42°; b.p. 46°; f.p. -1°F; d. 1.386 (20°) *moisture sensitive, pyrophoric* Note: Available prepacked in ALD cylinder- see 98-4002.	50g 100g
98-4002 HAZ	**Dimethylzinc, elec. gr. (99.999%-Zn) PURATREM, 97-5060, contained in 50 ml electropolished Swagelok® cylinder (96-1077) for CVD/ALD** *(544-97-8)* $Zn(CH_3)_2$; FW: 95.44; colorless liq.; m.p. -42°; b.p. 46°; f.p. -1°F; d. 1.386 (20°) *moisture sensitive, pyrophoric*	10g
30-3033 HAZ	**Zinc bromide (99.999%-Zn) PURATREM** *(7699-45-8)* $ZnBr_2$; FW: 225.19; white pwdr.; m.p. 394°; b.p. 650°; d. 4.201 *hygroscopic*	5g 25g
93-3052 amp HAZ	**Zinc chloride (99.99%-Zn) PURATREM** *(7646-85-7)* $ZnCl_2$; FW: 136.28; -10 mesh spheres; m.p. 283°; b.p. 732°; d. 2.91	10g 50g
93-3016	**Zinc oxide (99.999%-Zn) PURATREM** *(1314-13-2)* ZnO; FW: 81.37; white pwdr.; m.p. 1975°; d. 5.606	10g 50g
93-3041	**Zinc selenide (99.99%-Zn) PURATREM** *(1315-09-9)* ZnSe; FW: 144.33; yellow, granular solid; m.p. > 1100°; d. 5.42	5g 25g 100g
93-3023	**Zinc selenide (99.999%-Zn) PURATREM** *(1315-09-9)* ZnSe; FW: 144.33; yellow pwdr.; m.p. > 1100°; d. 5.42	10g 50g
30-3024	**Zinc sulfide (99.99%-Zn) (fused granules) PURATREM** *(1314-98-3)* ZnS; FW: 97.43; 2.5-5.0mm granules; m.p. 1700°; d. 4.10	5g 25g 100g
93-3046	**Zinc telluride (99.99%-Zn) PURATREM** *(1315-11-3)* ZnTe; FW: 192.97; gray pwdr.; m.p. 1240°; d. 6.34	10g 50g

ZIRCONIUM (Compounds)

40-4115 NEW amp HAZ	**Tetrakis(dimethylamino)zirconium(IV), 99% (99.99%-Zr) PURATREM TDMAZ** *(19756-04-8)* $Zr[N(CH_3)_2]_4$; FW: 267.53; light-yellow xtl.; m.p. 57-60°; b.p. 80° (0.1mm) *moisture sensitive, (store cold)* Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard1.	1g 5g 25g
40-1750 amp	**Zirconium(IV) t-butoxide (99.99%-Zr) PURATREM** *(2081-12-1)* $Zr(OC_4H_9)_4$; FW: 383.68; slightly yellow liq.; b.p. 90°/5mm; f.p. 185°F; d. 0.96 *moisture sensitive, (store cold)*	2g 10g 2 x 25g
40-2500 HAZ	**Zirconium(IV) dichloride oxide hydrate (99.99+%-Zr) PURATREM** *(15461-27-5)* $ZrOCl_2 \cdot XH_2O$; FW: 178.13; white xtl.	25g 100g
40-4750	**Zirconium(IV) sulfate tetrahydrate (99.99+%-Zr) PURATREM** *(7446-31-3)* $Zr(SO_4)_2 \cdot 4H_2O$; FW: 283.33 (355.39); white xtl.; m.p. 100° ($-3H_2O$)	25g 100g

STAINLESS STEEL BUBBLERS:
Vertical, Electropolished with fill-port, DOT4B, UN Stamped



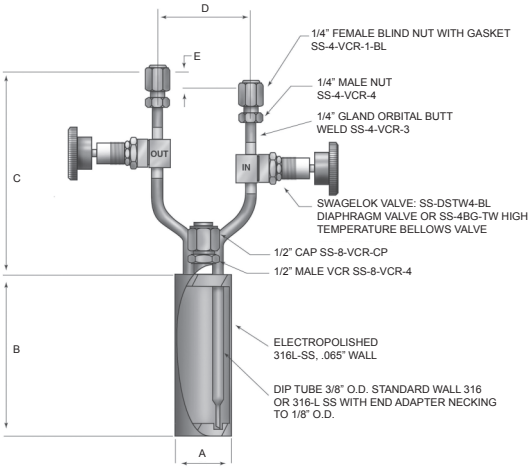
Stainless Steel Bubblers, vertical, electropolished with fill-port, PCTFE valve stem tip (121°C), DOT 4B, UN stamped

Catalog #	Vol. (mL)	A mm	B mm	C mm	D mm	E mm	Temp. Valve	Special Configuration
95-4151	150	51	108	143	83	13	Standard	
95-4290	300	51	187	143	83	13	Standard	
95-4598	600	76	164	143	83	13	Standard	
95-4998	1000	76	254	143	83	13	Standard	
95-5002	1200	102	184	143	83	13	Standard	
95-5003	1500	102	223	143	83	13	Standard	
95-5001	2000	102	292	143	83	13	Standard	
95-5011	3000	152	213	140	83	13	Standard	
95-3000	150	51	108	140	83	13	Standard	replaceable-seat valves with rotated handles
95-4153	150	51	108	143	83	13	Standard	with rotated handles

Stainless Steel Bubblers, vertical, electropolished with fill-port, high temperature valves (315°C), DOT 4B, UN stamped

Catalog #	Vol. (mL)	A mm	B mm	C mm	D mm	E mm	Temp. Valve	Special Configuration
95-0271	150	51	108	140	83	13	High	
95-0270	300	51	187	140	83	13	High	
95-4599	600	76	164	140	83	13	High	
95-4002	1200	102	184	143	83	13	High	
95-4155	150	51	108	140	83	13	High	with rotated handles
95-0276	150	51	108	140	83	13	High	with short dip tube, cut to 1 inch from top of bubbler
95-4157	200	51	150	140	83	13	High	with rotated handles
95-0280	300	51	187	140	83	13	High	with rotated handles
95-4295	300	51	187	140	83	13	High	with rotated handles, **no dip tube**
95-4610	600	76	164	127	83	13	High	with rotated handles, **no dip tube**, stems same height

STAINLESS STEEL BUBBLERS:
Vertical, Electropolished with fill-port



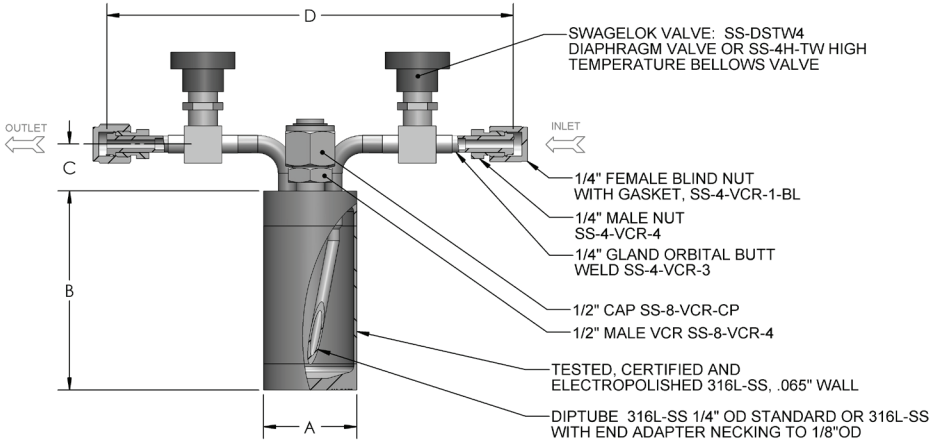
Stainless Steel Bubblers, vertical, electropolished with fill-port, PCTFE valve stem tip (121°C)

Catalog #	Vol. (mL)	A mm	B mm	C mm	D mm	E mm	Temp. Valve	Special Configuration
96-4151	150	51	108	140	83	13	Standard	
96-4290	300	51	187	140	83	13	Standard	
96-4598	600	76	163	140	83	13	Standard	
96-4998	1000	76	254	140	83	13	Standard	
96-5002	1000	102	165	140	83	13	Standard	
96-5003	1400	102	203	140	83	13	Standard	
96-5001	1800	102	254	140	83	13	Standard	
96-5011	2750	152	188	140	83	13	Standard	
96-4149	150	51	108	140	83	13	Standard	with short dip tube, cut 5cm from top of bubbler
96-4153	150	51	108	140	83	13	Standard	with rotated handles

Stainless Steel Bubblers, vertical, electropolished with fill-port, high temperature valves (315°C)

Catalog #	Vol. (mL)	A mm	B mm	C mm	D mm	E mm	Temp. Valve	Special Configuration
98-0271	150	51	108	140	83	13	High	
98-0270	300	51	187	140	83	13	High	
96-4599	600	76	163	140	83	13	High	
96-4996	1000	76	254	140	83	13	High	
98-0276	150	51	108	140	83	13	High	with short dip tube, cut to 1 inch from top of bubbler
98-0280	300	51	187	140	83	13	High	with rotated handles
96-4295	300	51	187	140	83	13	High	with rotated handles, **no dip tube**
96-4610	600	76	163	140	83	13	High	with rotated handles, **no dip tube,** stems same height

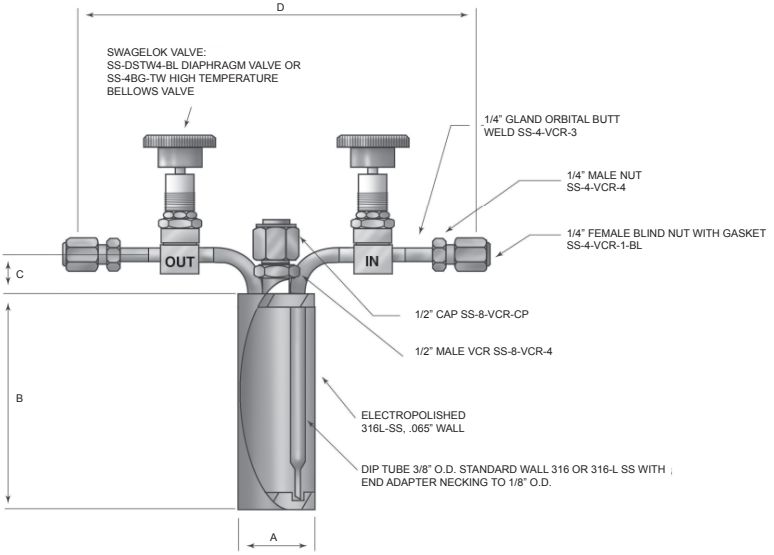
STAINLESS STEEL BUBBLERS:
Horizontal, Electropolished with fill-port, DOT4B, UN Stamped



Stainless Steel Bubblers, horizontal, electropolished with fill-port, PCTFE valve stem tip (121°C) DOT 4B, UN stamped							
Catalog #	**Vol. (mL)**	**A mm**	**B mm**	**C mm**	**D mm**	**Temp. Valve**	**Special Configuration**
95-5151	150	51	108	24	222	Standard	
95-5298	300	51	187	24	222	Standard	
95-5599	600	76	164	24	222	Standard	
95-5998	1000	76	254	24	222	Standard	
95-5004	2000	152	152	24	222	Standard	
95-0273	150	51	108	24	222	Standard	with reversed handles

Stainless Steel Bubblers, horizonal, electropolished with fill-port, high temperature valves (315°C) DOT 4B, UN stamped							
Catalog #	**Vol. (mL)**	**A mm**	**B mm**	**C mm**	**D mm**	**Temp. Valve**	**Special Configuration**
95-0272	150	51	108	24	222	High	
95-5006	300	51	187	24	222	High	
95-5007	600	76	164	24	222	High	
95-5008	1000	76	254	24	222	High	

STAINLESS STEEL BUBBLERS:
Horizontal, Electropolished with fill-port



Stainless Steel Bubblers, horizontal, electropolished with fill-port, PCTFE valve stem tip (121°C)

Catalog #	Vol. (mL)	A mm	B mm	C mm	D mm	Temp. Valve	Special Configuration
96-5151	150	51	108	24	222	Standard	
96-5298	300	51	187	24	222	Standard	
96-5599	600	76	163	24	222	Standard	
96-5998	1000	76	254	24	222	Standard	
96-5004	1800	102	254	24	222	Standard	
98-0273	150	51	108	24	222	Standard	with reversed handles
98-0275	150	51	108	24	222	Standard	with rotated handles

Stainless Steel Bubblers, horizonal, electropolished with fill-port, high temperature valves (315°C)

Catalog #	Vol. (mL)	A mm	B mm	C mm	D mm	Temp. Valve	Special Configuration
98-0272	150	51	108	24	222	High	
96-5006	300	51	187	24	222	High	
96-5007	600	76	163	24	222	High	
96-5008	1000	76	254	24	222	High	

Swagelok® Cylinder Assemblies for ALD

Standard Assembly

96-1070 Swagelok® Cylinder Assembly, 50ml with ¼" VCR Male Ball Valve and Female Nut for CVD/ALD

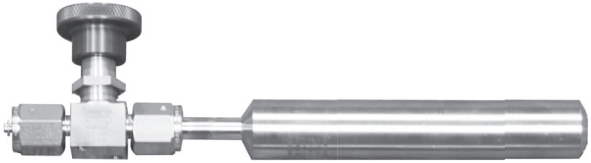
¼" VCR Male Ball Valve rated to 300°F or 148°C

Item Description	Category	Type	Cleaning	Temperature Rating
Swagelok® Cylinder, 50ml	Cylinder Body	Standard	SC-11	---
Swagelok® 1/4" Male Ball Valve, VCR Metal Gasket Face Seal Fitting	Valves	Standard	SC-10	300°F 148°C
Swagelok® 1/4" Female Nut	Female Nut	Standard	SC-10	---
Swagelok® Stainless 1/4" VCR Silver Plated Gasket Retainer Assembly, 2 pcs	Gasket Assembly	Silver plated	N/A	---

High-Temp Valve Assembly

96-1071 Swagelok® Cylinder Assembly, 50ml with ¼" VCR Male Bellows-Sealed Valve (High Temp) and Female Nut for CVD/ALD

¼" VCR Male Bellows-Sealed Valve (High Temp/EP) rated to 600°F or 315°C



Item Description	Category	Type	Cleaning	Temperature Rating
Swagelok® Cylinder, 50ml	Cylinder Body	Standard	SC-11	---
Swagelok® 1/4" Male Bellows-Sealed Valve (High-Temp) VCR Metal Gasket Seal Fitting	Valves	High Temp/ EP	SC-11	600°F 315°C
Swagelok® 1/4" Female Nut	Female Nut	Standard	SC-10	---
Swagelok® Stainless 1/4" VCR Silver Plated Gasket Retainer Assembly, 2 pcs	Gasket Assembly	Silver plated	N/A	---

Assembly components are not available for individual sale.

Standard Assembly

Swagelok® Cylinder, 50ml

Swagelok® 1/4" Female Nut

Swagelok® 1/4" Stainless 1/4" VCR Silver Plated Gasket Retainer Assembly

Valve Types

96-1070 Valve

96-1071 Valve

Swagelok® Cylinder Assemblies for ALD

Electropolished (EP) Assembly with Ball Valve or High-Temp Vale (Optional)

96-1075 Swagelok® Cylinder Assembly, 50ml with ¼" VCR Male Ball Valve (SC-11 cleaned) and Female Nut, electropolished for CVD/ALD

¼" VCR Male Ball Valve (EP) rated to 300°F or 148°C

Item Description	Category	Type	Cleaning	Temperature Rating
Swagelok® Cylinder, Electropolished, 50ml	Cylinder Body	EP	SC-11	---
Swagelok® 1/4" Male Ball Valve, VCR Metal Gasket Face Seal Fitting, SC-11 cleaned	Valves	EP	SC-11	300°F 148°C
Swagelok® 1/4" Female Nut, SC-11 cleaned	Female Nut	EP	SC-11	---
Swagelok® Stainless 1/4" VCR Unplated Gasket Retainer Assembly, 2 pcs	Gasket Assembly	Unplated	N/A	---

96-1076 Swagelok® Cylinder Assembly, 50ml with ¼" VCR Male Bellows-Sealed Valve (High-Temp) and Female Nut, electropolished for CVD/ALD

¼" VCR Male Bellows-Sealed Valve (High-Temp/EP) rated to 600°F or 315°C

Item Description	Category	Type	Cleaning	Temperature Rating
Swagelok® Cylinder, Electropolished, 50ml	Cylinder Body	EP	SC-11	---
Swagelok® 1/4" Male Bellows-Sealed Valve (High-Temp) VCR Metal Gasket Seal Fitting, SC-11 cleaned	Valves	High Temp/ EP	SC-11	600°F 315°C
Swagelok® 1/4" Female Nut, SC-11 cleaned	Female Nut	EP	SC-11	---
Swagelok® Stainless 1/4" VCR Unplated Gasket Retainer Assembly, 2 pcs	Gasket Assembly	Unplated	N/A	---

Assembly components are not available for individual sale.

Standard Assembly

Swagelok® Cylinder, Electropolished, 50ml

Swagelok® 1/4" Female Nut, SC-11 cleaned

Swagelok® 1/4" Stainless 1/4" VCR Unplated Gasket Retainer Assembly

Valve Types

96-1075 Valve

96-1076 Valve

Swagelok® Cylinder Assemblies for ALD

DP Valve Assembly

96-1077 **Swagelok® Cylinder Assembly, 50ml with ¼" VCR Male DP Valve (Ultra High Purity) and Female Nut, electropolished for CVD/ALD**

¼" VCR Male DP high pressure diaphragm Valve (Ultra High Purity/EP) rated to 50-320°F or 10-148°C

Item Description	Category	Type	Cleaning	Temperature Rating
Swagelok® Cylinder, Electropolished 50ml	Cylinder Body	EP	SC-11	---
Swagelok® 1/4" Male DP high pressure diaphragm Valve (Ultra High Purity), polyimide seat, VCR Metal Gasket Seal Fitting, SC-01 cleaned	Valves	Ultra High Purity/EP	SC-01	50° - 302°F 10° - 148°C
Swagelok® 1/4" Female Nut, SC-11 cleaned	Female Nut	EP	SC-11	---
Swagelok® Stainless 1/4" VCR Unplated Gasket Retainer Assembly, 2 pcs	Gasket Assembly	Unplated	N/A	---

96-1078 **Swagelok® Cylinder Assembly, 50ml with ¼" VCR Male DP High Pressure Valve (High Purity), PCTFE seat, VCR Metal Gasket Seal Fitting, Round Handle**

¼" VCR Male DP high pressure diaphragm Valve (High Purity/EP) rated to 250°F or 121°C

Item Description	Category	Type	Cleaning	Temperature Rating
Swagelok® Cylinder, Electropolished, 50ml	Cylinder Body	EP	SC-11	---
Swagelok® 1/4" Male DP high pressure diaphragm Valve (High Purity), PCTFE seat, VCR Metal Gasket Seal Fitting, Round handle, SC-11 cleaned	Valves	High Purity/ EP	SC-11	250°F 121°C
Swagelok® 1/4" Female Nut, SC-11 cleaned	Female Nut	EP	SC-11	---
Swagelok® Stainless 1/4" VCR Unplated Gasket Retainer Assembly, 2 pcs	Gasket Assembly	Unplated	N/A	---

Assembly components are not available for individual sale.

Ultra High Purity & DP Valve Assembly

Swagelok® Cylinder, Electropolished, 50ml

Swagelok® 1/4" Female Nut, SC-11 cleaned

Swagelok® 1/4" Stainless 1/4" VCR Unplated Gasket Retainer Assembly

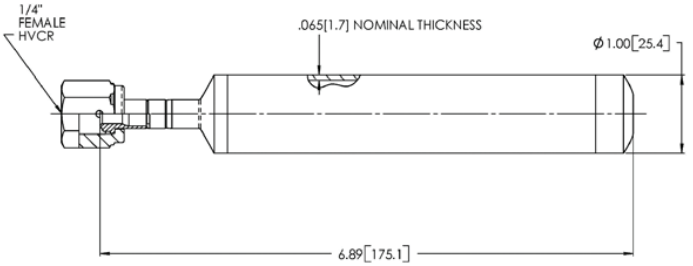
Valve Types

96-1077 Valve

96-1078 Valve

Swagelok® Cylinder Assemblies for ALD

Definition of Swagelok® Cleaning Codes	
SC-01	Ultra High Purity Process - DI water cleaning system is closed to the environment and limits contamination. A series of ultrasonic washing and multistage DI water rinse before drying.
SC-10	Standard Cleaning - Basic industrial procedures.
SC-11	Special Cleaning - Multistep process that ensures thorough cleaning, rinsing, draining and drying.

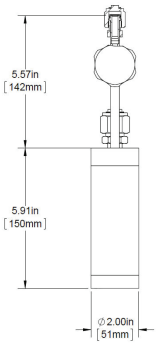


- Drawing is not to scale
- Dimensions are in inches [millimeters in brackets]
- Drawing subject to change without notice

Additional Cylinders for ALD

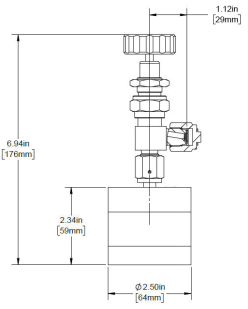
95-4154 Stainless steel cylinder, 200ml, single vertical stem, electropolished with fill-port, PCTFE valve stem tip, DOT 4B, UN stamped

Cylinder Size	2” Diameter
Cylinder Working Volume	200ml
Cylinder Total Volume	233ml
Cylinder Tare Weight	2.75
Design Pressure	300PSI
Test Pressure	600PSI
Design Temperature	250°F/121°C
Fillport	1/2” MCVR
Outlet Valve	SS-DSTW4
D.O.T. Specification	4B-300



95-0281 Stainless steel cylinder, 125ml, horizontal in line, with angled Bellows valve (150°C), DOT 4B, UN stamped

Cylinder Size	2.5” Diameter
Cylinder Working Volume	125ml
Cylinder Total Volume	137ml
Cylinder Tare Weight	1.89 lbs
Design Pressure	260PSI
Test Pressure	520PSI
Design Temperature	-10 to 150 C*
Inlet Valve	FUJIKIN, FUB-81-6.35-PI
D.O.T. Specification	4B-260

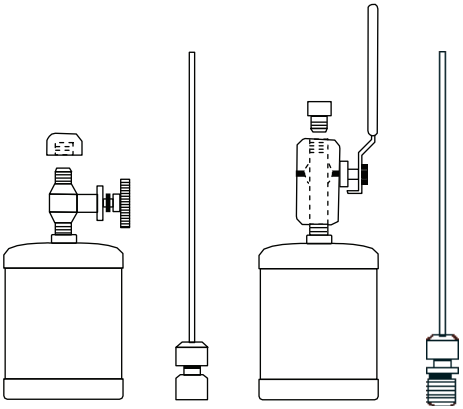


The FUB-81-6.35-PI valve is rated for 150°C but per the manufacturer, it can be heated to 175°C if the total number of cycles does not exceed 200 annually during usage

Cylinders and Adapters

Caution!

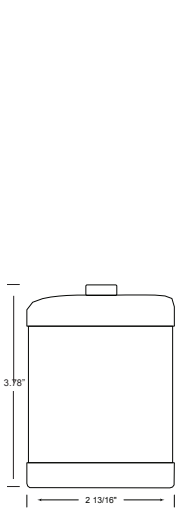
Due to the hazardous nature of many of the materials packaged in metal cylinders, we strongly recommend that all users read the technical note associated with the catalog numbers below posted at strem.com carefully before using the product. The cylinders and valves are used primarily for the safe transport and storage of pyrophoric materials. As with any air-sensitive compound, the cylinder should be taken into an inert atmosphere bag or box to remove the product. If you are unsure of the handling procedures and need assistance, please contact the Operations & Logisitics Manager at (978) 499-1600 (All countries) or (800) 647-8736 (USA & Canada only).



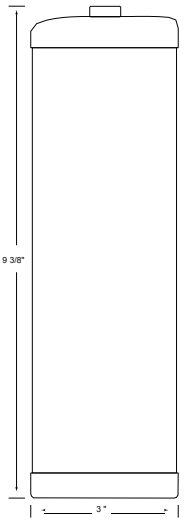
TYPE I SYSTEM | **TYPE I ADAPTER 96-8500** | **TYPE II SYSTEM** | **TYPE II ADAPTER 96-8501**

Cat #	Description
96-8500	Swagelok® Type I Adapter
96-8501	Swagelok® Type II Adapter
96-8105	Brass needle valve (Type I)
96-8100	Brass ball valve (Type II)
96-8000	Cylinder, carbon steel, 275 ml
96-8005	Cylinder, carbon steel, 900 ml

For instruction details on Type I or Type II systems please visit strem.com



96-8000

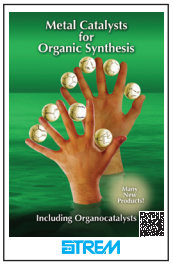


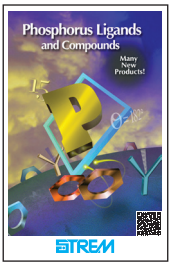
96-8005

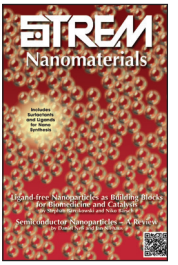
96-8000	
Contents:	275 ml
Design Pressure:	240 psig
Outlet Fitting:	1/4 NPTF pipe thread size
Weight:	0.7 lbs
Dimensions:	2 13/16” dia x 3 7/8”
D.O.T. Specs:	DOT-4 B240

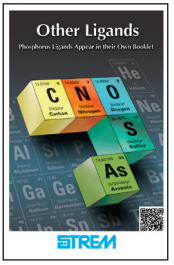
96-8005	
Contents:	900 ml
Design Pressure:	240 psig
Outlet Fitting:	1/4 NPTF pipe thread size
Weight:	1.5 lbs
Dimensions:	3” dia x 9 3/8”
D.O.T. Specs:	DOT-4 B240ET

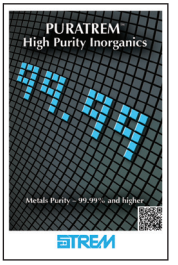
Available Booklets

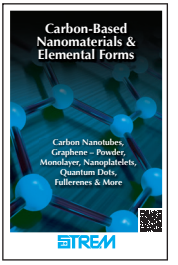


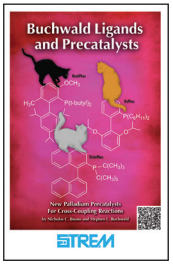


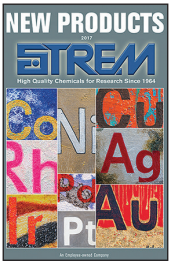


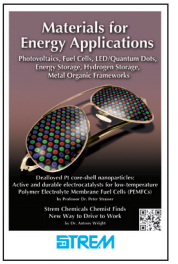


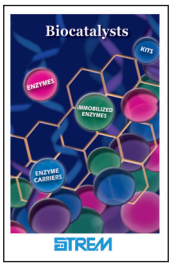


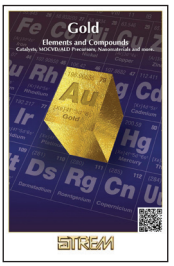


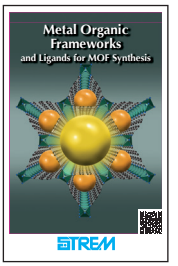












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