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Thin Film Evaporation Guide

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Material	Symbol	Melting Point °C	Density (bulk, g/cm^3)	Z-ratio	Temperature °C @ Vapor Pressure (Torr)			Evaporation Method	Crucible Liner	Remarks
					10^{-8}	10^{-6}	10^{-4}			
Aluminum	Al	660	2.7	1.08	677	821	1010	eBeam (Xlnt)	TiB$_2$-TiC, TiB$_2$-BN, graphite, BN	High deposition rates possible. Al wets IMCS
Aluminum Antimonide	AlSb	1080	4.3	—	—	—	—	eBeam (fair)	TiB$_2$-BN, BN, C, Al$_2$O$_3$	Co-evaporation is the best approach
Aluminum Arsenide	AlAs	1600	3.7	—	—	—	~1300	eBeam (poor)	TiB$_2$-BN, BN, Al$_2$O$_3$	Co-evaporation can work but typically done with MBE
Aluminum Bromide	AlBr$_3$	97	3.01	—	—	—	~50	eBeam (poor)	graphite, W	eBeam or thermal evaporation of anhydrous AlBr$_3$ powder
Aluminum Carbide	Al$_4$C$_3$	1400	2.36	—	—	—	~800	eBeam (fair)	graphite, W	eBeam evaporation from powder, but CVD is a better approach
Aluminum 2% Copper	Al2%Cu	640	2.8	—	—	—	—	eBeam (fair)	TiB$_2$-TiC, BN	eBeam evaporation of Al-Cu alloys is possible, but sputter deposition is a better approach
Aluminum Fluoride	AlF$_3$	1257 sublimes	3.07	—	410 sublimes	490	700	eBeam (fair)	graphite, Mo, W	Films tend to be porous, but smooth
Aluminum Nitride	AlN	— sublimes	3.26	—	—	—	~1750	eBeam (fair)	TiB$_2$-TiC, graphite, BN	Reactive evaporation of Al in N$_2$ or ammonia partial pressure
Aluminum Oxide (Alumina)	Al$_2$O$_3$	2045	3.97	0.336	—	—	1550	eBeam (Xlnt)	W, graphite	Swept beam with low deposition rates (< 3 Å/sec)
Aluminum 2% Silicon	Al2%Si	640	2.6	—	—	—	1010	eBeam (fair)	TiB$_2$-TiC, BN	eBeam evaporation of Al-Si alloys is possible, but sputter deposition is a better approach
Antimony	Sb	630	6.68	—	279 sublimes	345	425	eBeam (fair)	BN, graphite, Al$_2$O$_3$	As the deposition rate is increased from 3-5 Å/s the grain size decreases and film coverage improves
Antimony Telluride	Sb$_2$Te$_3$	619	6.5	—	—	—	600	eBeam (fair)	graphite, BN, W	Best results are achieved with powdered source material, relatively high deposition rates can be achieved
Antimony Trioxide	Sb$_2$O$_3$	656	5.2 or 5.76	—	— sublimes	—	~300	eBeam (good)	BN, Al$_2$O$_3$	eBeam evaporation from powder or granules
Antimony Triselenide	Sb$_2$Se$_3$	611	—	—	—	—	—	eBeam (fair)	graphite	Can be co-evaporated with Se to overcome variable stoichiometric effects
Antimony Trisulphide	Sb$_2$S$_3$	550	4.64	—	—	—	~200	eBeam (good)	Al$_2$O$_3$, Mo, Ta	Films without substrate heating are amorphous, while polycrystalline films form on heated substrates
Arsenic	As	814	5.73	—	107 sublimes	150	210	eBeam (poor)	Al$_2$O$_3$, BeO, graphite	Sputter deposition is the preferred method for deposition of elemental arsenic
Arsenic Selenide	As$_2$Se$_3$	360	4.75	—	—	—	—	eBeam (poor)	Al$_2$O$_3$, quartz	Deposition efficiency increases with deposition rate
Arsenic Trisulphide	As$_2$S$_3$	300	3.43	—	—	—	~400	eBeam (fair)	Al$_2$O$_3$, quartz, Mo	Thin films tend to be richer in As compared to the source material
Arsenic Tritelluride	As$_2$Te$_3$	362	—	—	—	—	—	eBeam (poor)	Al$_2$O$_3$, quartz	CVD is the preferred deposition technique for this material
Barium	Ba	710	3.78	—	545	627	735	eBeam (fair)	W, Ta, Mo	Reacts with ceramics. Ba evaporation pellets are often shipped with protective coatings which must be removed
Barium Chloride	BaCl$_2$	962	3.86	—	—	—	~650	eBeam (poor)	W, Mo	Swept beam and slow power ramp to precondition and outgas the source material
Barium Fluoride	BaF$_2$	1280	4.83	—	— sublimes	—	~700	eBeam (fair)	W, Mo	Better consistency in refractive index is achieved via CVD
Barium Oxide	BaO	1923	5.72 or 5.32	—	—	—	~1300	eBeam (fair)	Al$_2$O$_3$, quartz	Swept beam and slow power ramp to precondition and outgas the source material
Barium Sulphide	BaS	2200	4.25	—	—	—	1100	eBeam (poor)	W, Mo	Sputter deposition is the preferred deposition technique
Barium Titanate	BaTiO$_3$	Decomposes	6	—	Decomposes			eBeam (poor)	W, Mo	BaTiO$_3$ will decompose as single source. Co-evaporate with Ti to maintain Ba/Ti ratio

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Beryllium	Be	1278	1.85	—	710	878	1000	eBeam (Xlnt)	graphite	Very high deposition rates are possible. Avoid Be powder sources due to toxicity
Beryllium Chloride	$BeCl_2$	440	1.9	—	—	—	~150	eBeam (poor)	graphite	CVD is the preferred deposition technique for this material
Beryllium Fluoride	BeF_2	800	1.99	—	— sublimes	—	~200	eBeam (fair)	graphite	Avoid powder sources due to toxicity
Beryllium Oxide	BeO	2530	3.01	—	—	—	1900	eBeam (fair)	graphite, Al_2O_3	Thin films can also be produced via reactive evaporation of Be with O_2
Bismuth	Bi	271	9.8	—	330	410	520	eBeam (Xlnt)	Al_2O_3, graphite	Post deposition thermal annealing significantly enhances film properties. However, vapors are toxic
Bismuth Fluoride	BiF_3	727	8.75	—	— sublimes	—	~300	eBeam (poor)	graphite	Sublimes at relatively low temperature, so reasonable vapor pressure can be achieved
Bismuth Oxide	Bi_2O_3	820	8.9	—	—	—	~1400	eBeam (poor)	—	eBeam evaporation from Bi_2O_3 source is possible, but variations in thin film stoichiometry may occur
Bismuth Selenide	Bi_2Se_3	710	7.66	—	—	—	~650	eBeam (fair)	graphite, quartz	Sputter deposition is preferred, but co-evaporation using Bi and Se sources is possible
Bismuth Telluride	Bi_2Te_3	585	7.85	—	—	—	~600	eBeam (fair)	graphite, quartz	Sputter deposition is preferred, but co-evaporation using Bi and Te sources is possible
Bismuth Titanate	$Bi_2Ti_2O_7$	—	—	—	Decomposes			eBeam (poor)	graphite, quartz	Decomposes when evaporated. Sputter deposition is preferred, but can be reactively co-evaporated in O_2 partial pressure
Bismuth Trisulphide	Bi_2S_3	685	7.39	—	—	—	—	eBeam (poor)	graphite, W	Can be co-evaporated from Bi and S sources
Boron	B	2100	2.36	0.389	1278 sublimes	1548	1797	eBeam (Xlnt)	graphite, W	Can react with graphite and tungsten crucible liners. Requires high power to evaporate
Boron Carbide	B_4C	2350	2.5	—	2500	2580	2650	eBeam (good)	graphite, W	Ion assisted eBeam deposition with Ar can improve film adhesion
Boron Nitride	BN	2300	2.2	—	— sublimes	—	~1600	eBeam (poor)	graphite, W	Ion assisted eBeam deposition with N_2 produces stoichiometric thin films, but sputter deposition is preferred
Boron Oxide	B_2O_3	460	1.82	—	—	—	~1400	eBeam (good)	W, Mo	eBeam evaporation from bulk source material produces stoichiometric thin films
Boron Trisulphide	B_2S_3	310	1.55	—	—	—	800	eBeam (poor)	graphite	—
Cadmium	Cd	321	8.64	—	64	120	180	eBeam (fair)	Al_2O_3, quartz	Dedicated system is recommended, since Cd can contaminate other purity sensitive depositions
Cadmium Antimonide	CdSb	456	6.92	—	—	—	—	—	—	—
Cadmium Arsenide	Cd_3As_2	721	6.21	—	—	—	—	eBeam (poor)	quartz	Thin films can be produced by eBeam evaporation from bulk source material, but CVD is a preferred deposition method
Cadmium Bromide	$CdBr_2$	567	5.19	—	—	—	~300	—	—	—
Cadmium Chloride	$CdCl_2$	570	4.05	—	—	—	~400	—	—	—
Cadmium Fluoride	CdF_2	1070	5.64	—	—	—	~500	—	—	—
Cadmium Iodide	CdI_2	400	5.3	—	—	—	~250	—	—	CdI_2 films have been deposited by thermal evaporation on glass substrates using stoichiometric powders
Cadmium Oxide	CdO	900	6.95	—	—	—	~530	eBeam (poor)	Al_2O_3, quartz	Can be produced by reactive evaporation of Cd in partial pressure of O_2 or reactive sputtering with O_2
Cadmium Selenide	CdSe	1264	5.81	—	— sublimes	—	540	eBeam (good)	Al_2O_3, quartz, graphite	eBeam evaporation from bulk source material produces uniform films

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Cadmium Siliside	$CdSiO_2$	—	—	—	—	—	~600	—	—	Reports in the literature of deposition by CVD
Cadmium Sulphide	CdS	1750	4.82	—	—	—	550	eBeam (fair)	Al_2O_3, quartz, graphite	Substrate heating improves film adhesion. Deposition rates of 15 Å/sec are possible
					sublimes					
Cadmium Telluride	CdTe	1098	6.2	—	—	—	450	eBeam (fair)	Al_2O_3, quartz, graphite	High quality CdTe thin films on glass substrates at 100°C have been fabricated with eBeam deposition
Calcium	Ca	842	1.56	—	272	357	459	eBeam (poor)	Al_2O_3, quartz	Low partial pressure of O_2 in the vacuum chamber is required to avoid oxidizing the Ca
					sublimes					
Calcium Fluoride	CaF_2	1360	3.18	—	—	—	~1100	eBeam (Xlnt)	quartz, Ta	Deposition rate of 20 Å/sec are easily achieved with eBeam deposition. Substrate heating improves film quality
Calcium Oxide	CaO	2580	3.35	—	—	—	~1700	eBeam (poor)	ZrO_2, graphite	Forms volatile oxides with W and Mo
Calcium Silicate	$CaO-SiO_2$	1540	2.9	—	—	—	—	eBeam (good)	quartz	Post deposition thermal annealing at 500°C improves film quality and adhesion
Calcium Sulphide	CaS	—	2.18	—	—	—	1100	eBeam (poor)	ZrO_2, graphite	Decomposition of CaS bulk source material can be overcome by co-evaporation with S
		sublimes								
Calcium Titanate	$CaTiO_3$	1975	4.1	—	1490	1600	1690	eBeam (poor)	—	Sputter deposition is the preferred method
Calcium Tungstate	$CaWO_4$	1620	6.06	—	—	—	—	eBeam (good)	W, ZrO_2	Substrate heating improves the crystallinity of the deposit
Carbon (diamond)	C	—	1.8-2.3	0.22	1657	1867	2137	eBeam (Xlnt)	graphite, W	Better film adhesion results from eBeam evaporation compared to vacuum arc deposition
		sublimes			sublimes					
Cerium	Ce	795	8.23	—	970	1150	1380	eBeam (good)	Al_2O_3, BeO, graphite	Ce deposits readily oxidize when exposed to air
Ceric Oxide	CeO_2	2600	7.3	—	1890	2000	2310	eBeam (good)	graphite, Ta	Stoichiometric films are best achieved using reactive evaporation with O_2. Substrate heating improves film quality
					sublimes					
Cerium Fluoride	CeF_3	1418	6.16	—	—	—	~900	eBeam (good)	Mo, Ta, W	Can be produced using bulk source material. Substrate heating from 150-300°C improves adhesion and film quality
Cerium Oxide	Ce_2O_3	1692	6.87	—	—	—	—	eBeam (fair)	graphite, Ta	Mixed CeO_2-Ce_2O_3 films can be reduced to Ce_2O_3 by heating in UHV at 725°C
Cesium	Cs	28	1.87	—	-16	22	30	eBeam (poor)	quartz	—
Cesium Bromide	CsBr	636	4.44	—	—	—	~400	—	—	—
Cesium Chloride	CsCl	646	3.97	—	—	—	~500	—	—	—
Cesium Fluoride	CsF	684	3.59	—	—	—	~500	—	—	—
Cesium Hydroxide	CsOH	272	3.67	—	—	—	~550	—	—	—
Cesium Iodide	CsI	621	4.51	—	—	—	~500	eBeam (poor)	quartz, Pt	Stoichiometric CsI films are possible from bulk, source material, but good film coverage can be a challenge
Chiolote	$Na_5Al_3F_{14}$	—	2.9	—	—	—	~800	eBeam (poor)	Al_2O_3	Stoichiometric chiolite films are difficult to fabricate with eBeam evaporation
Chromium	Cr	1890	7.2	0.305	837	977	1157	eBeam (good)	W, graphite	Films are very adherent. High deposition rates possible, but uniformity can be an issue
					sublimes					
Chromium Boride	CrB	2760	6.17	—	—	—	—	—	—	—
Chromium Bromide	$CrBr_2$	842	4.36	—	—	—	550	—	—	—
Chromium Carbide	Cr_3C_2	1890	6.68	—	—	—	~2000	eBeam (fair)	W	Can be fabricated by co-evaporation of Cr and C
Chromium Chloride	CrCl2	824	2.75	—	—	—	550	—	—	—

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Chromium Oxide	Cr_2O_3	2435	5.21	—	—	—	~2000	eBeam (good)	W	Stoichiometry can be maintained by reactive evaporation in O_2
Chromium Siliside	Cr_3Si	1710	6.51	—	—	—	—	—	—	—
Chromium Silicon Monoxide	Cr-SiO	Influenced by Composition						eBeam (good)	W	The quality Cr-SiO cermet films fabricated with eBeam evaporation improves with annealing at 425° C
Cobalt	Co	1495	8.9	—	850	990	1200	eBeam (Xlnt)	Al_2O_3, BeO, graphite	Pellets or powder both work well as source material
Cobalt Bromide	$CoBr_2$	678	4.91	—	— sublimes	—	400	—	—	—
Cobalt Chloride	$CoCl_2$	740	3.36	—	— sublimes	—	472	—	—	—
Cobalt Oxide	CoO	1935	5.68	—	—	—	—	eBeam (fair)	—	CoO can be fabricated by reactive evaporation with O_2, but sputter deposition is the preferred fabrication method
Copper	Cu	1083	8.92	0.437	727	857	1017	eBeam (Xlnt)	Al_2O_3, Mo Ta, graphite	Poor adhesion on most substrates. Use thin adhesion layer of Cr or Ti
Copper Chloride	CuCl	422	3.53	—	—	—	~600	eBeam (poor)	quartz	Stoichiometric CuCl films have been produced from pellets and powder source material
Copper Oxide	Cu_2O	1235	6	—	— sublimes	—	~600	eBeam (good)	graphite, Al_2O_3, Ta	Thin films have been fabricated from stoichiometric Cu_2O powder
Copper Sulfide	CuS	1113	6.75	—	— sublimes	—	~500	—	—	—
Cryolite	Na_3AlF_6	1000	2.9	—	1020	1260	1480	eBeam (good)	W, graphite	Good films can be fabricated using pellets or powder source material.
Dyprosium	Dy	1409	8.54	—	625	750	900	eBeam (good)	W	Quality thin films can be fabricated from bulk source material
Dyprosium Fluoride	DyF_3	1360	6	—	— sublimes	—	~800	eBeam (good)	W, Ta	Bulk source material is available in pellets and powder form
Dyprosium Oxide	Dy_2O_3	2340	7.81	—	—	—	~1400	eBeam (fair)	W	Thin films have been fabricated from bulk source material
Erbium	Er	1497	9.06	0.74	650 sublimes	775	930	eBeam (good)	W, Ta	—
Erbium Fluoride	ErF_2	1380	6.5	—	—	—	~950	—	—	—
Erbium Oxide	Er_2O_3	2400	8.64	—	—	—	~1600	eBeam (fair)	W	Reactive evaporation of bulk material in O_2 atmosphere maintains stoichiometry.
Europium	Eu	822	5.26	—	280 sublimes	360	480	eBeam (fair)	Al_2O_3	—
Europium Fluoride	EuF_2	1380	6.5	—	—	—	~950	—	—	—
Europium Oxide	Eu_2O_3	2400	8.64	—	—	—	~1600	eBeam (good)	W	Reactive evaporation of Eu_2O_3 powder or granules in O_2 atmosphere maintains stoichiometry.
Europium Sulphide	EuS	—	5.75	—	—	—	—	eBeam (good)	W	eBeam evaporation of EuS powder in UHV (10^{-8} torr base vacuum) has been reported in the literature
Gadolinium	Gd	1312	7.89	—	760	900	1175	eBeam (Xlnt)	Al_20_3, W	eBeam evaporation of Gd directly from the water cooled Cu hearth has been reported
Gadolinium Oxide	Gd_2O_3	2310	7.41	—	—	—	—	eBeam (fair)	Al_20_3, W	Reactive evaporation of Gd_2O_3 pellets in O_2 maintains thin film stoichiometry. Refractive index increases with substrate heating
Gallium	Ga	30	5.9	—	619	742	907	eBeam (good)	graphite, Al_2O_3, BeO, quartz	Alloys with refractory metals
Gallium Antimonide	GaSb	710	5.6	—	—	—	—	eBeam (fair)	W, Ta	eBeam evaporation from bulk source material is possible

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Gallium Arsenide	GaAs	1238	5.3	—	—	—	—	eBeam (good)	graphite, W	Film quality is improved with ion assisted evaporation
Gallium Nitride	GaN	— sublimes	6.1	—	—	—	~200	eBeam (fair)	graphite, Al_2O_3, BeO, quartz	Reactive evaporation of Ga in 10^{-3} N_2
Gallium Oxide (ß)	Ga_2O_3	1900	5.88	—	—	—	—	eBeam (fair)	graphite, W	Reactive evaporation of Ga_2O_3 in O_2 partial pressure maintains stoichiometry
Gallium Phosphide	GaP	1540	4.1	—	—	770	920	eBeam (fair)	quartz, W	Co-evaporation of Ga and P has been reported
Gemanium	Ge	937	5.35	0.516	812	957	1167	eBeam (Xlnt)	Al_2O_3, quartz, graphite, Ni	Uniform films achieved with slow power ramp and swept beam
Germanium Nitride	Ge_3N_2	450	5.2	—	— sublimes	—	~650	eBeam (poor)	—	Sputtering is the preferred method of fabrication
Germanium Oxide	GeO_2	1086	6.24	—	—	—	~625	eBeam (good)	graphite, Al_2O_3, quartz	GeO_2 stoichiometry can be maintained by reactive evaporation of bulk source material in O_2
Germanium Telluride	GeTe	725	6.2	—	—	—	381	—	—	—
Gold	Au	1062	19.32	0.381	807	947	1132	eBeam (Xlnt)	W, Al_2O_3, graphite, BN	Metal spitting can be an issue. Mitigate by slow power ramp with swept beam and low carbon content in source material
Hafnium	Hf	2230	13.09	—	2160	2250	3090	eBeam (good)	W	—
Hafnium Boride	HfB_2	3250	10.5	—	—	—	—	—	—	Fabrication of HfB_2 films by CVD has been reported
Hafnium Carbide	HfC	4160	12.2	—	— sublimes	—	~2600	—	—	—
Hafnium Nitride	HfN	2852	13.8	—	—	—	—	—	—	HfN films have been produced by reactive RF sputtering of Hf in N_2 + Ar
Hafnium Oxide	HfO_2	2812	9.68	—	—	—	~2500	eBeam (fair)	graphite, W	Can be fabricated by reactive evaporation in O_2 or using bulk source material. Post process annealing at 500°C improves film quality
Hafnium Silicide	$HfSi_2$	1750	7.2	—	—	—	—	eBeam (fair)	W	$HfSi_2$ thin films have been fabricated by eBeam evaporation of Hf on Si substrates followed by annealing at 750°C for an hour
Holmium	Ho	1470	8.8	—	650 sublimes	770	950	eBeam (good)	W	—
Holmium Fluoride	HoF_3	1143	7.64	—	—	—	~800	—	quartz	—
Holmium Oxide	Ho_2O_3	2370	8.41	—	—	—	—	eBeam (fair)	W	Ho_2O_3 thin films have been fabricated by eBeam evaporation of powdered source material or reactive evaporation of Ho in O_2
Indium	In	157	7.3	0.841	487	597	742	eBeam (Xlnt)	Mo, graphite, Al_2O_3	Wets Cu and W. Mo liner is preferred
Indium Antimonide	InSb	535	5.8	—	500	—	~400	eBeam (fair)	graphite, W	Thin films fabricated using powdered source material
Indium Arsenide	InAs	943	5.7	—	780	870	970	—	—	Sputter deposition is the preferred thin film fabrication technique
Indium Oxide	In_2O_3	1565	7.18	—	— sublimes	—	~1200	eBeam (good)	Al_2O_3	Thin films have been produced by reactive evaporation of powdered In_2O_3 in O_2 partial pressure.
Indium Phosphide	InP	1058	4.8	—	—	630	730	eBeam (fair)	graphite, W	Deposits are P rich
Indium Selenide	In_2Se_3	890	5.7	—	—	—	—	eBeam (fair)	graphite, W	Thin films have been fabricated by eBeam evaporation from powdered InSe. Post process annealing improves crystallinity
Indium Sesquisulphide	In_2S_3	1050	4,9	—	— sublimes	—	850	—	—	—

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Indium Sulphide	In_2S	653	5.87	—	—	—	650	—	—	—
Indium Telluride	In_2Te_3	667	5.8	—	—	—	—	—	—	Thin films from co-evaporation of In and Te sources has been reported.
Indium Tin Oxide	In_2O_3-SnO_2	1800	6.43-7.14	—	—	—	—	eBeam (good)	graphite	Thin films have been produced from 90% In_2O_3-10%SnO_2 powder in O_2 partial pressure. Substrate temperature of 250°C improves electrical conductivity of resulting films
Iridium	Ir	2459	22.65	—	1850	2080	2380	eBeam (fair)	W	Better uniformity and adhesion can be achieved using sputter deposition
Iron	Fe	1535	7.86	0.349	858	998	1180	eBeam (Xlnt)	Al_2O_3, BeO, graphite	Molten Fe will attack and adhere to graphite, severely limiting crucible liner life
Iron Bromide	$FeBr_2$	689	4.64	—	—	—	561	—	—	—
Iron Chloride	$FeCl_2$	670	2.98	—	—	—	300	—	—	—
					sublimes					
Iron Iodide	FeI_2	592	5.31	—	—	—	400	—	—	—
Iron Oxide	FeO	1425	5.7	—	—	—	—	eBeam (poor)	—	Sputter deposition preferred.
Iron Oxide	Fe_2O_3	1565	5.24	—	—	—	—	eBeam (good)	Al_2O_3, BeO, graphite	Fe_2O_3 thin films fabricated by reactive evaporation of Fe in 0.1 Pa O_2 partial pressure has been reported
Iron Sulphide	FeS	1195	4.84	—	—	—	—	—	—	—
Lanthanum	La	920	6.17	—	990	1212	1388	eBeam (Xlnt)	W, Ta	—
Lanthanum Boride	LaB_6	2210	2.61	—	—	—	—	eBeam (fair)	—	LaB_6 films and coatings are more commonly produced with sputter deposition.
Lanthanum Bromide	$LaBr_3$	783	5.06	—	—	—	—	—	—	—
Lanthanum Fluoride	LaF_3	1490	6	—	—	—	900	eBeam (good)	Ta, Mo	Ion assisted eBeam evaporation improves film density and adhesion
					sublimes					
Lanthanum Oxide	La_2O_3	2250	5.84	—	—	—	1400	eBeam (good)	W, graphite	C contamination can occur with graphite crucible liners
Lead	Pb	328	11.34	1.13	342	427	497	eBeam (Xlnt)	Al_2O_3, quartz, graphite, W	—
Lead Bromide	$PbBr_2$	373	6.66	—	—	—	~300	—	—	—
Lead Chloride	$PbCl_2$	501	5.85	—	—	—	~325	—	—	—
Lead Fluoride	PbF_2	822	8.24	—	—	—	~400	—	—	—
					sublimes					
Lead Iodide	PbI_2	502	6.16	—	—	—	~500	—	—	—
Lead Oxide	PbO	890	9.53	—	—	—	~550	eBeam (fair)	Al_2O_3, quartz, W	Stoichiometric PbO thin films can be produced using powdered source material
Lead Stannate	$PbSnO_3$	1115	8.1	—	670	780	905	eBeam (poor)	Al_2O_3, W	Disproportionates
Lead Selenide	PbSe	1065	8.1	—	—	—	~500	eBeam (fair)	Al_2O_3, graphite	—
					sublimes					
Lead Sulphide	PbS	1114	7.5	—	—	—	550	eBeam (fair)	Al_2O_3, quartz	Post deposition annealing at 150°C improves the crystallinity of the films
					sublimes					
Lead Telluride	PbTe	917	8.16	—	780	910	1050	eBeam (poor)	Al_2O_3, graphite	Films produced from bulk PbTe tend to be Te rich. Sputter deposition is preferred
Lead Titanate	$PbTiO_3$	—	7.52	—	—	—	—	eBeam (fair)	W, Ta	Thin films of $PbTiO_3$ with reactive co-evaporation of PbO powder and TiO_2 pellets in O_2 partial pressure has been reported
Lithium	Li	179	0.53	—	227	307	407	eBeam (good)	Ta, Al_2O_3, BeO	Li films oxidize readily in air
Lithium Bromide	LiBr	547	3.46	—	—	—	~500	—	—	—

Material	Symbol	Melting Point °C	Density (bulk, g/cm^3)	Z-ratio	Temperature °C @ Vapor Pressure (Torr)			Evaporation Method	Crucible Liner	Remarks
					10^{-8}	10^{-6}	10^{-4}			
Lithium Chloride	LiCl	613	2.07	—	—	—	400	—	—	—
Lithium Fluoride	LiF	870	2.6	—	875	1020	1180	eBeam (good)	W, Mo, Ta, Al_2O_3	Rate control important for optical films. Outgas prior to deposition rastered beam
Lithium Iodide	LiI	446	4.06	—	—	—	400	—	—	—
Lithium Oxide	Li_2O	1427	2.01	—	—	—	850	—	—	—
Lutetium	Lu	1652	9.84	—	—	—	1300	eBeam (Xlnt)	Al_2O_3	—
Lutetuim Oxide	Lu_2O_3	2489	9.81	—	—	—	1400	eBeam (fair)	Al_2O_3	eBeam evaporation of powdered source material results in stoichiometric films by post deposition rapid thermal anneal in O_2 at 400-600°C
Magnesium	Mg	651	1.74	—	185	247 sublimes	327	eBeam (good)	W, graphite, Al_2O_3	Powder is flammable. High deposition rates are possible
Magnesium Aluminate	$MgAl_2O_4$	2135	3.6	—	—	—	—	—	—	eBeam deposition from $MgAl_2O_4$ powder has been reported
Magnesium Bromide	$MgBr_2$	700	3.72	—	—	—	~450	—	—	—
Magnesium Chloride	$MgCl_2$	708	2.32	—	—	—	400	—	—	—
Magnesium Fluoride	MgF_2	1266	2.9-3.2	—	—	—	1000	eBeam (Xlnt)	Al_2O_3, graphite, Mo	Best optical properties result from substrate heating at 300°C and a deposition rate of ≤ 5 Å/sec
Magnesium Iodide	MgI_2	700	4.24	—	—	—	200	—	—	—
Magnesium Oxide	MgO	2800	3.58	—	—	—	1300	eBeam (good)	Al_2O_3, graphite	Stoichiometric films result from reactive evaporation in partial pressure of 10^{-3} torr O_2
Manganese	Mn	1244	7.2	—	507	572 sublimes	647	eBeam (good)	W, Al_2O_3, BeO	—
Manganese Bromide	$MnBr_2$	695	4.38	—	—	—	500	—	—	—
Manganese Chloride	$MnCl_2$	650	2.98	—	—	—	450	—	—	—
Manganese IV Oxide	MnO_2	535	5.03	—	—	—	—	eBeam (poor)	W, Mo, Al_2O_3	Stoichiometric thin films have been produced by reactive evaporation of Mn powder in 10^{-3} torr O_2
Manganese Sulphide	MnS	1615	3.99	—	—	—	1300	—	—	—
Mercury	Hg	-39	13.55	—	-68	-42	-6	—	—	Toxic, not recommended for evaporation processes
Mercury Sulphide	HgS	sublimes	8.1	—	—	— sublimes	250	eBeam (poor)	Al_2O_3	Toxic and decomposes, not recommended for evaporation processes
Molybdenum	Mo	2610	10.22	—	1592	1822	2117	eBeam (Xlnt)	graphite, W	Films are smooth, hard and adherent
Molybdenum Boride	MoB_2	2100	7.12	—	—	—	—	—	—	—
Molybdenum Carbide	Mo_2C	2687	9.18	—	—	—	—	—	—	Thin films of Mo_2C by sputter deposition and CVD have been reported
Molybdenum Disulphide	MoS_2	1185	4.8	—	—	—	~50	—	—	Fabrication of MoS_2 by CVD has been reported
Molybdenum Silicide	$MoSi_2$	2050	6.3	—	—	—	~50	—	—	$MoSi_2$ films have been produced by sputter deposition
Molybdenum Trioxide	MoO_3	795	4.7	—	—	—	~900	eBeam (fair)	Al_2O_3, graphite, BN, Mo	Substrate heating improves film crystallinity
Neodymium	Nd	1024	7	—	731	871	1062	eBeam (Xlnt)	Al_2O_3, Ta	—
Neodymium Fluoride	NdF_3	1410	6.5	—	—	—	~900	eBeam (good)	W, Mo, Al_2O_3	Substrate heating at 360°C improved film quality
Neodymium Oxide	Nd_2O_3	2272	7.24	—	—	—	~1400	eBeam (good)	W, Ta	Films may be oxygen deficient. Refractive index increases with increasing substrate temperature

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					10^{-8}	10^{-6}	10^{-4}			
Nickel	Ni	1453	8.91	0.331	927	1072	1262	eBeam (Xlnt)	Al_2O_3, BeO, W, graphite	Differential thermal expansion between Ni and graphite can cause graphite crucible liners to crack on cooling
Nickel Bromide	$NiBr_2$	963	4.64	—	—	—	362	—	—	—
					sublimes					
Nickel Chloride	$NiCl_2$	1001	3.55	—	—	—	444	—	—	—
					sublimes					
Nickel Oxide	NiO	1990	7.45	—	—	—	~1470	eBeam (good)	Al_2O_3, W	Substrate temperature of 125°C improves film adhesion and quality. Use of NiO powder as source material mitigates spitting
Niobium (Columbium)	Nb (Cb)	2468	8.55	—	1728	1977	2287	eBeam (Xlnt)	graphite	Ion assisted eBeam evaporation modifies Nb film stress from tensile to compressive at a substrate temperature of 400°C
Niobium Boride	NbB_2	3050	6.97	—	—	—	—	—	—	—
Niobium Carbide	NbC	3800	7.82	—	—	—	—	eBeam (fair)	graphite	NbC thin films on Ti has been reported
Niobium Nitride	NbN	2573	8.4	—	—	—	—	eBeam (fair)	graphite, W	NbN films have been fabricated using reactive evaporation and reactive sputtering in N_2. NbN films by ion assisted evaporation have also been reported
Niobium Oxide	NbO	—	6.27	—	—	—	1100	—	—	—
Niobium Pentoxide	Nb_2O_5	1530	4.47	—	—	—	—	—	—	Nb_2O_5 films produced by RF magnetron sputtering using a stoichiometric target have been reported
Niobium Telluride	NbTe	—	7.6	—	—	—	—	—	—	—
Niobium-Tin	Nb_3Sn	—	—	—	—	—	—	eBeam (Xlnt)	graphite, Ta	Films produced by co-evaporation of Nb and Sn have been reported. Substrate heating improves film homogeneity
Niobium Trioxide	Nb_2O_3	1780	7.5	—	—	—	—	—	—	—
Osmium	Os	1700	22.5	—	2170	2430	2760	—	—	—
Palladium	Pd	1550	12.4	—	—	—	1192	eBeam (Xlnt)	W, Al_2O_3, graphite	Susceptible to metal spitting. Mitigate with slow power ramp and longer soak before deposition
Palladium Oxide	PdO	870	8.31	—	—	—	575	eBeam (poor)	Al_2O_3	Decomposes
Phosphorus	P	41.4	1.82	—	327	361	402	eBeam (poor)	Al_2O_3	Reacts violently in air
Platinum	Pt	1769	21.45	0.245	1292	1492	1747	eBeam (Xlnt)	W, Al_2O_3, graphite	Low deposition rates (< 5 Å/sec) preferred for film uniformity. Carbon contamination with graphite liners is possible at high power
Plutonium	Pu	635	19	—	—	—	—	—	—	Toxic. Radioactive
Polonium	Po	254	9.4	—	117	170	244	—	—	Toxic. Radioactive
Potassium	K	64	0.86	—	23	60	125	—	quartz	Highly reactive in air
Potassium Bromide	KBr	730	2.75	—	—	—	~450	—	quartz	Use gentle preheat to outgas
Potassium Chloride	KCl	776	1.98	—	—	—	~510	eBeam (fair)	Ta, quartz, Mo	Use gentle preheat to outgas
Potassium Fluoride	KF	880	2.48	—	—	—	~500	eBeam (poor)	quartz	Use gentle preheat to outgas
Potassium Hydroxide	KOH	360	2.04	—	—	—	~400	—	—	—
Potassium Iodide	KI	72	3.13	—	—	—	~500	—	—	—
Praseodymium	Pr	931	6.78	—	800	950	1150	eBeam (good)	W, graphite, Ta	Pr films will oxidize in air
Praseodymium Oxide	Pr_2O_3	2125	6.88	—	—	—	1400	eBeam (good)	W, graphite, ThO_2	Loses oxygen. Reports of Pr_2O_3 thin films grown by MBE

Material	Symbol	Melting Point °C	Density (bulk, g/cm³)	Z-ratio	Temperature °C @ Vapor Pressure (Torr)			Evaporation Method	Crucible Liner	Remarks
					10^{-8}	10^{-6}	10^{-4}			
Radium	Ra	700	5	—	246	320	416	—	—	—
Rhenium	Re	3180	20.53	—	1928	2207	2571	eBeam (good)	W, graphite	Substrate heating at 600°C improves film properties
Rhenium Oxide	ReO_3	297	8.2	—	—	—	~100	eBeam (good)	W, graphite	Films produced by reactive evaporation of Re in 10^{-3} torr O_2
Rhodium	Rh	1966	12.41	—	1277	1472	1707	eBeam (good)	W, graphite	—
Rubidium	Rb	38.5	1.47	—	-3	37	111	—	quartz	—
Rubidium Chloride	RbCl	715	2.76	—	—	—	~500	—	quartz	—
Rubidium Iodide	RbI	642	3.55	—	—	—	~400	—	quartz	—
Ruthenium	Ru	2700	12.45	—	1780	1990	2260	eBeam (poor)	W	Material spits using eBeam. Sputter deposition is preferred
Samarium	Sm	1072	7.54	—	373	460	573	eBeam (good)	Al_2O_3	—
Samarium Oxide	Sm_2O_3	2350	7.43	—	—	—	—	eBeam (good)	W	Loses oxygen. Sputter deposition is preferred
Samarium Sulphide	Sm_2S_3	1900	5.72	—	—	—	—	—	—	—
Scandium	Sc	1539	2.99	—	714	837	1002	eBeam (Xlnt)	W, Mo, Al_2O_3	Alloys with Ta
Scandium Oxide	Sc_2O_3	2300	3.86	—	—	—	~400	eBeam (fair)	W	Loses oxygen. Films produced by reactive sputtering in O_2 have been reported
Selenium	Se	217	4.79	—	89	125	170	eBeam (good)	W, Mo, graphite, Al_2O_3	Toxic. Can contaminate vacuum systems
Silicon	Si	1410	2.42	0.712	992	1147	1337	eBeam (fair)	Ta, graphite, BeO	High deposition rates possible. Molten Si can attack graphite liners limiting crucible liner life
Silicon Boride	SiB_6	—	2.47	—	—	—	—	—	—	—
Silicon Carbide	SiC	2700	3.22	—	—	—	1000	eBeam (fair)	W	Sputter deposition is the preferred thin film fabrication technique
Silicon Dioxide	SiO_2	1610-1710	2.2-2.7	1	—	— Influenced by composition	~1025	eBeam (Xlnt)	Al_2O_3, Ta, graphite, W	Swept beam is critical to avoid hole drilling, since the source material will have a shallow melt pool
Silicon Monoxide	SiO	1702	2.1	—	—	— sublimes	850	eBeam (fair)	W, Ta, graphite	Thin films from bulk SiO material has been reported
Silicon Nitride	Si_3N_4	— sublimes	3.44	—	—	—	~800	—	—	Thin films of Si_3N_4 by reactive sputter deposition have been reported
Silicon Selenide	SiSe	—	—	—	—	—	550	—	—	—
Silicon Sulphide	SiS	— sublimes	1.85	—	—	—	450	—	—	—
Sillicon Telluride	$SiTe_2$	—	4.39	—	—	—	550	—	—	—
Silver	Ag	961	10.49	0.529	847	958	1105	eBeam (Xlnt)	W, Al_2O_3, Ta, Mo, graphite	Swept beam during melt and focused beam during deposition is recommended for higher deposition rates
Silver Bromide	AgBr	432	6.47	—	—	—	~380	—	—	—
Silver Chloride	AgCl	455	5.56	—	—	—	~520	—	—	—
Silver Iodide	AgI	558	5.67	—	—	—	~500	—	—	Thin films of AgI fabricated by thermal evaporation have been reported
Sodium	Na	97	0.97	—	74	124	192	—	quartz	Use gentle preheat to outgas. Metal reacts violently in air
Sodium Bromide	NaBr	755	3.2	—	—	—	~400	—	—	—
Sodium Chloride	NaCl	801	2.16	—	—	—	530	—	—	Thin films of NaCl fabricated by thermal evaporation in Knudsen cells with quartz crucibles have been reported
Sodium Cyanide	NaCN	563	—	—	—	—	~550	—	—	—

Material	Symbol	Melting Point °C	Density (bulk, g/cm^3)	Z-ratio	Temperature °C @ Vapor Pressure (Torr)			Evaporation Method	Crucible Liner	Remarks
					10^{-8}	10^{-6}	10^{-4}			
Sodium Fluoride	NaF	988	2.79	—	—	—	~700	eBeam (good)	W, Ta, graphite, BeO	Use gentle preheat to outgas. NaF thin films produced from powder source material and 230°C substrate heating have been reported
Sodium Hydroxide	NaOH	318	2.13	—	—	—	~470	—	—	—
Strontium	Sr	769	2.6	—	239	309	403	eBeam (poor)	graphite, quartz	Wets refractory metals. May react strongly in air
Strontium Fluoride	SrF_2	1190	4.24	—	—	—	~1000	eBeam (poor)	Al_2O_3, W, quartz	Thin films of SrF_2 produced by eBeam and thermal evaporation have been reported
Strontium Oxide	SrO	2460	4.7	—	—	— sublimes	1500	eBeam (poor)	Al_2O_3	Loses oxygen. Reacts with W and Mo
Strontium Sulphide	SrS	>2000	3.7	—	—	—	—	—	—	Decomposes
Sulphur	S_8	115	2	—	13	19	57	eBeam (poor)	quartz	Can contaminate vacuum systems
Tantalum	Ta	2996	16.6	—	1960	2240	2590	eBeam (Xlnt)	graphite	High melting point of Ta limits crucible liner selection. High vacuum is required to mitigate oxygen incorporation in films
Tantalum Boride	TaB_2	3000	12.38	—	—	—	—	—	—	—
Tantalum Carbide	TaC	3880	14.65	—	—	—	~2500	—	—	—
Tantalum Nitride	TaN	3360	16.3	—	—	—	—	eBeam (fair)	graphite	Thin films of TaN can be produced by reactive evaporation in 10^{-3} torr N_2
Tantalum Pentoxide	Ta_2O_5	1800	8.74	—	1550	1780	1920	eBeam (good)	graphite, Ta	Swept beam to avoid hole drilling. A thin Ti layer will improve adhesion to the substrate
Tantalum Sulphide	TaS_2	1300	—	—	—	—	—	—	—	—
Technetium	Tc	2200	11.5	—	1570	1800	2090	—	—	—
Tellurium	Te	452	6.25	—	157	207	277	eBeam (poor)	Al_2O_3, quartz, graphite	Wets refractory metals
Terbium	Tb	1357	8.27	—	800	950	1150	eBeam (Xlnt)	Al_2O_3, graphite, Ta	Thin films produced by sputter deposition and thermal evaporation have also been reported
Terbium Fluoride	TbF_3	1176	—	—	—	—	~800	—	—	Sputter deposition is preferred
Terbium Oxide	Tb_2O_3	2387	7.87	—	—	—	1300	—	—	Thin films prepared by pulsed laser deposition have been reported
Terbium Peroxide	Tb_4O_7	2340	7.3	—	—	—	—	—	—	Annealing of Tb_2O_3 films at 800°C in air to produce stable Tb_4O_7 has been reported
Thallium	Tl	302	11.85	—	280	360	470	eBeam (poor)	Al_2O_3, quartz, graphite	Thallium and its compounds are very toxic. Wets freely
Thallium Bromide	Tlbr	480	7.56	—	—	— sublimes	~250	—	—	Thermal evaporation of TlBr thin films has been reported
Thallium Chloride	TlCl	430	7	—	—	— sublimes	~150	—	—	—
Thallium Iodide (ß)	TlI	440	7.09	—	—	—	~250	eBeam (poor)	Al_2O_3, quartz	Low stress thin films can be produced by eBeam evaporation with a substrate temperature of 100°C
Thallium Oxide	Tl_2O_3	717	9.65	—	—	—	350	—	—	Disproportionates at 850°C to Tl_2O
Thorium	Th	1875	11.7	—	1430	1660	1925	eBeam (Xlnt)	W, Ta, Mo	Toxic and mildly radioactive
Thorium Bromide	$ThBr_4$	—	5.67	—	—	— sublimes	—	—	—	—
Thorium Carbide	ThC_2	2273	8.96	—	—	—	~2300	—	—	—
Thorium Dioxide	ThO_2	3050	10.03	—	—	—	~2100	eBeam (good)	W	Stable stoichiometric films of ThO_2 produced from powdered source material have been reported

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					10^{-8}	10^{-6}	10^{-4}			
Thorium Fluoride	ThF_4	1110	6.3	—	—	—	~750	eBeam (fair)	Ta, Mo, graphite	Use gentle preheat to outgas. Substrate temperature of 175°C improves film adhesion and quality
Thorium Oxyfluoride	$ThOF_2$	900	9.1	—	—	—	—	eBeam (poor)	W, Ta, Mo, graphite	Does not evaporate stoichiometrically, resulting films are primarily ThF_4
Thorium Sulphide	ThS_2	—	6.8	—	—	—	—	—	—	—
Thulium	Tm	1545	9.32	—	461	554 sublimes	680	eBeam (good)	Al_2O_3	—
Thulium Oxide	Tm_2O_3	—	8.9	—	—	—	1500	—	—	Thin films of Tm_2O_3 by eBeam evaporation and MBE have been reported
Tin	Sn	232	7.75	0.724	682	807	997	eBeam (Xlnt)	Al_2O_3, Ta, graphite, W	High deposition rates possible, but uniformity may suffer. Slow power ramp to mitigate cavitation of melt pool
Tin Oxide	SnO_2	1127	6.95	—	—	— sublimes	~1000	eBeam (Xlnt)	Al_2O_3, quartz	Substrate temperature above 200°C improves film crystallinity
Tin Selenide	SnSe	861	6.18	—	—	—	~400	—	—	Stoichiometric thin films of SnSe produced by thermal evaporation of powdered source material have been reported
Tin Sulphide	SnS	882	5.08	—	—	—	~450	eBeam (poor)	quartz, W	Thin films prepared by eBeam evaporation of SnS powder and reactive co-evaporation of Sn and S have been reported
Tin Telluride	SnTe	780	6.44	—	—	—	~450	eBeam (poor)	quartz	Thin films of SnTe produced with eBeam evaporation at a substrate temperature of 300°C have been reported
Titanium	Ti	1675	4.5	0.628	1067	1235	1453	eBeam (Xlnt)	W, graphite, TiC	Films are very adherent to almost any substrate
Titanium Boride	TiB_2	2980	4.5	—	—	—	—	—	—	Sputter deposition is the preferred thin film fabrication technique
Titanium Carbide	TiC	3140	4.93	—	—	—	~2300	eBeam (fair)	W, graphite	eBeam evaporation of TiC thin films with and without ion beam assistance have been reported
Titanium Dioxide	TiO_2	1640	4.29	—	—	—	~1300	eBeam (good)	W, graphite, Ta	Stoichiometric thin films of TiO_2 have been produced from powder source material and a substrate temperature of 600°C
Titanium Monoxide	TiO	1750	—	—	—	—	~1500	eBeam (good)	W, graphite, Ta	Outgas with gentle preheat prior to deposition
Titanium Nitride	TiN	2930	5.43	—	—	—	—	eBeam (good)	W, graphite, TiC	Thin films have been prepared by reactive evaporation of Ti in N_2 partial pressure
Titanium Sesquioxide	Ti_2O_3	2130	4.6	—	—	—	—	eBeam (good)	W, Ta, graphite	Stoichiometric films have been produced by reactive evaporation of Ti_2O_3 powder in 2.5 x 10^{-4} torr O_2
Tungsten	W	3410	19.3	0.163	2117	2407	2757	eBeam (good)	W	Long, slow preheat is required to condition the source material. Raster the electron beam to avoid hole drilling
Tungsten Boride	WB_2	2900	12.75	—	—	—	—	—	—	—
Tungsten Carbide	W_2C	2860	17.15	—	1480	1720	2120	eBeam (good)	W, graphite	Thin films prepared by eBeam evaporation of powdered source material have been reported. RF Sputter deposition is widely reported
Tungsten Telluride	WTe_3	—	9.49	—	—	—	—	—	—	—
Tungsten Trioxide	WO_3	1473	7.16	—	—	— sublimes	980	eBeam (good)	W	Thin films are most commonly prepared using WO_3 powder source material
Uranium	U	1132	19.07	—	1132	1327	1582	eBeam (good)	W, Mo, graphite	Depleted uranium thin films oxidize easily even in low partial pressure of O_2
Uranium Carbide	UC_2	2260	11.28	—	—	—	2100	—	—	—

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					10^{-8}	10^{-6}	10^{-4}			
Uranium Dioxide	UO_2	2176	10.9	—	—	—	—	eBeam (fair)	W	Stoichiometric thin films produced by reactive evaporation of depleted uranium in O_2 partial pressure have been reported
Uranium Fluoride	UF_4	~1000	—	—	—	—	300	—	—	Thin films fabricated by sputter deposition of depleted uranium by F^- ions has been reported
Uranium Oxide	U_3O_8	Decomposes	8.3	—	—	—	—	—	—	Thin films produced by reactive sputter deposition of depleted uranium targets in O_2 have been reported.
Uranium Phosphide	UP_2	—	8.57	—	—	—	1200	—	—	—
Uranium Sulphide	U_2S_3	—	—	—	—	—	1400	—	—	—
Vanadium	V	1890	5.96	—	1162	1332	1547	eBeam (Xlnt)	W, graphite, Ta	Wets Mo. eBeam evaporation is preferred
Vanadium Boride	VB_2	2400	5.1	—	—	—	—	—	—	—
Vanadium Carbide	VC	2810	5.77	—	—	—	~1800	—	—	—
Vanadium Dioxide	VO_2	1967	4.34	—	— sublimes	—	~575	eBeam (poor)	W, graphite	Difficult to maintain stoichiometry by eBeam evaporation, sputter deposition is preferred
Vanadium Nitride	VN	2320	6.13	—	—	—	—	—	—	—
Vanadium Pentoxide	V_2O_5	690	3.36	—	—	—	~500	eBeam (good)	W, graphite	Thin films prepared from powdered source material are nearly stoichiometric. Post process annealing at 280° in O_2 restores full stoichiometry
Vanadium Silicide	VSi_2	1700	4.42	—	—	—	—	—	—	—
Ytterbium	Yb	824	6.98	—	520 sublimes	590	690	eBeam (good)	Al_2O_3, W, Ta	Store Yb evaporation source material in N_2 desiccator to mitigate oxidation
Ytterbium Fluoride	YbF_3	1157	8.17	—	—	—	~800	eBeam (fair)	Ta, Mo, W	Preheat slowly and evaporate at ≤ 10Å/sec to mitigate dissociation
Ytterbium Oxide	Yb_2O_3	2346	9.17	—	— sublimes	—	~1500	eBeam (fair)	Al_2O_3, W, Ta	Thin films produced by reactive evaporation in 8 x 10^{-5} torr O_2 have been reported.
Yttrium	Y	1509	4.48	—	830	973	1157	eBeam (Xlnt)	W, Al_2O_3	Substrate heating at 300°C improves adhesion and film smoothness
Yttrium Aluminum Oxide	$Y_3Al_5O_{12}$	1990	—	—	—	—	—	eBeam (good)	W, Al_2O_3	Films prepared from powdered source material, typically with dopants. YAG films post deposition annealed at 1100°C in vacuum improves crystallinity
Yttrium Fluoride	YF_3	1387	4.01	—	—	—	—	eBeam (good)	W, Ta, Mo, Al_2O_3	eBeam evaporation at a rate of ≤ 10Å/sec and substrate temperature of 200°C produces crystalline films with good adhesion
Yttrium Oxide	Y_2O_3	2680	4.84	—	— sublimes	—	~2000	eBeam (good)	graphite, W	eBeam evaporated films can be oxygen deficient, post deposition annealing in 10^{-3} torr O_2 at 525°C results in stoichiometric films.
Zinc	Zn	419	7.14	0.514	127	177	250	eBeam (Xlnt)	W, Al_2O_3, quartz, graphite	Evaporates well under a wide range of conditions
Zinc Antimonide	Zn_3Sb_2	546	6.3	—	—	—	—	—	—	—
Zinc Bromide	$ZnBr_2$	394	4.22	—	—	—	~300	—	—	—
Zinc Fluoride	ZnF_2	87	4.84	—	—	—	~800	eBeam (fair)	quartz, W	Thin films prepared by eBeam evaporation of powdered source material have been reported. Substrate heating at 400°C improved crystallinity
Zinc Nitride	Zn_3N_2	—	6.22	—	—	—	—	—	—	Reactive sputter deposition in N_2 has been reported

Material	Symbol	Melting Point °C	Density (bulk, g/cm^3)	Z-ratio	Temperature °C @ Vapor Pressure (Torr)			Evaporation Method	Crucible Liner	Remarks
					10^{-8}	10^{-6}	10^{-4}			
Zinc Oxide	ZnO	1975	5.61	—	—	—	~1800	eBeam (fair)	quartz, W	Quality thin films fabricated using eBeam evaporation at a rate of 8Å/sec and a substrate temperature of 300°C has been reported
Zinc Selenide	$ZnSe$	1526	5.42	—	—	—	660	eBeam (fair)	W, Ta, Mo, quartz	Deposition rate of ≤ 5 Å/sec. Thin films are polycrystalline and a substrate temperature of 300°C improves adhesion and size of crystallites
Zinc Sulphide	ZnS	1830	4.09	—	—	—	~800	eBeam (good)	W, Ta, Mo, quartz	Thin films produced by eBeam evaporation display a preferred (111) orientation and best optical properties result from a 400°C substrate temperature
					sublimes					
Zinc Telluride	$ZnTe$	1238	6.34	—	—	—	~600	eBeam (fair)	W, Ta, Mo, quartz	Stoichiometric thin films produced by eBeam evaporation have good crystallinity with a substrate temperature of 230°C. Optical properties are thickness dependent
Zircon	$ZrSiO_4$	2550	4.56	—	—	—	—	—	—	—
Zirconium	Zr	1852	6.4	—	1477	1702	1987	eBeam (Xlnt)	W, quartz	Alloys with W. Thin films oxidize readily
Zirconium Boride	ZrB_2	3040	6.08	—	—	—	—	eBeam (good)	W, quartz	Stoichiometric films prepared by co-evaporation of Zr and B have been reported
Zirconium Carbide	ZrC	3540	6.73	—	—	—	~2500	eBeam (poor)	graphite	Quality thin films of ZrC using pulsed laser deposition have been reported
Zirconium Nitride	ZrN	2980	7.09	—	—	—	—	—	—	Thin films of ZrN prepared by N_2 ion assisted evaporation of Zr have been reported
Zirconium Oxide	ZrO_2	2700	5.49	—	—	—	~220	eBeam (good)	W, graphite	Reactive evaporation in 10^{-3} torr O_2 produce as deposited stoichiometric films. For eBeam evaporated films, post deposition annealing in O_2 restores stoichiometry
Zirconium Silicide	$ZrSi_2$	1700	4.88	—	—	—	—	—	—	eBeam evaporated Zr on Si substrates forms $ZrSi_2$ following post deposition thermal annealing at 600°C