

Evaporation Materials

4M Electro-Optics Co.,Ltd

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Al	Ag	Au
Cu	Rh	

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CaF ₂	NaF ₂	SiO ₂ +Al ₂ O ₃
NaF	AlF ₃	YbF ₃
CrF ₃ +CaF ₂	SiO ₂	ErF ₃
Na ₃ AlF ₆	SrF ₃	
KF	BaF ₂	

3. Medium refractive index materials 08

Al ₂ O ₃	CeF ₃	ZrO ₂ +Al ₂ O ₃
LaF ₃	Al ₂ O ₃ +MgO	BiF ₃
DyF ₃	WO ₃	BaTiO ₃
YF ₃	Al ₂ O ₃ +TiO ₂	SnO+Al ₂ O ₃
SmF ₃	SnO ₂ +Pt	SrTiO ₃
NdF ₃	MgO	

4. High refractive index materials 09

Nd ₂ O ₃	NiO	TiO ₂ +Nb ₂ O ₅
Gd ₂ O ₃	SnO ₂	TiO ₂ + Ta ₂ O ₅
Sm ₂ O ₃	SnO ₂ +In ₂ O ₃	Sb ₂ O ₃
Sc ₂ O ₃	ZrO ₂ +TiO ₂	V ₂ O ₃
Y ₂ O ₃	Cr ₂ O ₃	ZnS
SiO	LaTiO ₃	Bi ₂ O ₃
Ti ₂ O ₃	Nb ₂ O ₅	CdS
Ti ₃ O ₅	PrTiO ₃	CuO
TiO	Pr(TiO ₃) ₂	Fe ₂ O ₃
TiO ₂	ZrO ₂ +Ta ₂ O ₅	CdTe
ZrO ₂ +Y ₂ O ₃	ZnO	Si
Pr ₆ O ₁₁	HfO ₂	CdSe
ZrO ₂	Ta ₂ O ₅	
Dy ₂ O ₃	CeO ₂	

Metal and alloy thin-film materials



Formula	Melting Point ^o C	Evaporation Source	Refractive Index at 550nm	Transparency Range	Application
AL	660	B			Cold light coating HR coating
Ag	961	EB			HR coating
Au	1064	B			HR coating Conductive coating
Cu	1085	EB			HR coating Protected coating
Rh	1966	EB			HR coating

Low refractive index



Evaporation material	Chemical Formula	Refractive Index at 550nm	Transparency Range	Shape			Melting Point ^o C	Purity	Typical Application	Recommended Evaporation Source	Risk and Safety Indication
				Granules	Tablets	Crystal granules					
Calcium fluoride	CaF ₂	1.23-1.46	0.15-12 μ m		•	•	1360	99.90% 99.999%	AR coating	B(W, Ta, Mo)	CAS No.7789-75-5
Sodium fluoride	NaF	1.29-1.30	0.2-14 μ m		•	•	992	99.90%	Infrared coating	B(Mo)	CAS No. 7681-49-4
Chromic fluoride+ Calcium fluoride	CrF ₃ +CaF ₂	1.3-1.4		•	•			99.90%	Applied to infrared wavelength to form homogeneous dense film	B(W, Ta, Mo)	CAS No.7788-97-8/7789-75-5
Cryolite	Na ₃ AlF ₆	1.32-1.35	0.2-1.4 μ m	•	•		1000	99.90%	Wide transparency range, excellent performance in infrared wavelength, usually applied to Infrared coating	B(Mo, Ta)	CAS No.15096-52-3 R48/23/25,R20/22,R51/53,S45,S60,S61
Potassium fluoride	KF	1.35		•	•		880	99.95%	Filter and UV coating		CAS No.7789-23-3
Magnesium fluoride	MgF ₂	1.38	0.11-10 μ m			•	1266	99.99%	Far Infrared coating	B(W, Ta, Mo)	CAS No.7783-40-6 R20/21/22,R36/37/38,R64,S22,S26,S28,S36/37
Aluminium fluoride	AlF ₃	1.38	0.2-20 μ m	•			900	99.90%	Multilayer coating AR coating Decorative coating Glasses coating UV coating	B	CAS No.7784-18-1
Silicon dioxide	SiO ₂	1.45-1.46	0.2-9 μ m	•	•	•	1700	99.99%	UV coating	E	CAS No.7631-86-9
Strontium fluoride	SrF ₂	1.45	0.2-10 μ m	•	•		1190	99.90%	AR coating Cold light coating Filter Insulating coating Glasses coating UV coating	B(W, Mo)	
Barium fluoride	BaF ₂	1.47	0.25-15 μ m	•	•		1280	99.90%	Infrared coating	B	CAS No. 7787-32-8 R20/21/22,R36/37 /38,S22,S26,S28,S36/37
Silicon dioxide+ Aluminium oxide	SiO ₂ +Al ₂ O ₃	1.48	0.3-7 μ m	•	•		2000	99.99%	Infrared coating	E	CAS No. 7631-86-9/1344-28-1
Ytterbium fluoride	YbF ₃	1.52	0.22-12 μ m	•			1157	99.99%	AR coating Glasses coating	E	CAS No.13760-80-0
Erbium fluoride	ErF ₃			•			1350	99.99%	Wide transparency range, excellent performance in infrared wavelength, usually applied to Infrared coating		CAS No.13760-83-3

B: Resistance Heating (Evaporation source material as indicated in the brackets)

E: Electron Beam; R:Reaction Evaporation; S:Sputtering; RS:Reaction Sputtering

Medium refractive index



Evaporation material	Chemical Formula	Refractive Index at 550nm	Transparency Range	Shape			Melting Point ^o C	Purity	Typical Application	Recommended Evaporation Source	Risk and Safety Indication
				Granules	Tablets	Crystal granules					
Aluminium oxide	Al ₂ O ₃	1.54	0.17-9μm	•	•		2020	99.90% 99.99%	AR coating Glasses coating Protective coating	B(W), E	CAS No.1 344-28-1
Lanthanum fluoride	LaF ₃	1.56	0.2-12μm	•	•		1490	99.90%	UV coating	B(W, Mo)	CAS No.13709-38-1 R20/21 /22,R36/37 /38 R64,S22,S26,S28,S36/37
Dysprosium fluoride	DyF ₃	1.56	0.22-12μm	•	•		1360	99.90%			CAS No.13569-80-7
Yttrium fluoride	YF ₃	1.59	0.22-14μm	•			1387	99.99%	Excellent performance in infrared wavelength		CAS No.13709-49-4 R20/21/22,R36/37/38,S22,S26,28
Samarium fluoride	SmF ₃	1.59	0.22-14μm	•	•		1306	99.99%	Infrared coating	B,E	CAS No.13765-24-7
Neodymium fluoride	NdF ₃	1.61	0.22-6μm	•	•		1410	99.90%	Infrared coating	B(Ta, Mo)	CAS No.13709-42-7 R20/21 /22,R36/37 /38,S22,S26,S28
Cerium fluoride	CeF ₃	1.63	0.3-0.5μm	•	•		1460	99.90%	AR coating Glasses coating	B(W), E	R20/21/22,R36/37 /38,S22,S26,S28
Aluminium oxide+ Magesium oxide	Al ₂ O ₃ +MgO	1.65-1.7		•	•		1473	99.90%	Higher refractive index than Al ₂ O ₃ Easy to evaporate, various ratios available upon customers' request		CAS No.1344-28-1/1309-48-4
Tungsten oxide	WO ₃	1.65-1.7	0.3-10μm	•	•		1473	99.90%	Transition coating		CAS No.1 314-3 5-8
Aluminium oxide+ Titanium dioxide	Al ₂ O ₃ +TiO ₂	1.7		•	•		1127	99.90%	Higher refractive index than Al ₂ O ₃ Easy to evaporate, various ratios available upon customers' request		CAS No.1344-28-1/13463-67-7
Stannic oxide+Platinum	SnO ₂ +Pt	1.7	0.17-9μm	•	•		2800	99.90%	Applied to sputtering to form sensitive film. Various ratios available upon customers' request		CAS No.18282-10-5/7440-06-4
Magnesium oxide	MgO	1.7	0.23-9μm	•	•			99.90%	AR coating	B(W, Ta), E	CAS No.1309-48-4
Zirconium dioxide+ Aluminium oxide	ZrO ₂ +Al ₂ O ₃	1.7		•	•			99.99%	Resistant to chemical attack Various ratios available upon customers' request		CAS No.1314-23-4/1344-28-1
Bismuth fluoride	BiF ₃	1.74(1μm)	0.26-20μm	•	•		722	99.90%	Infrared coating	B(C), E	CAS No.7787-61-3
barium fluoride	BaTiO ₃	1.66(10μm)		•	•		1620	99.99%			CAS No.12047-27-7
Tin oxide+ Aluminium oxide	SnO+Al ₂ O ₃			•	•			99.90%	Conductive coating		CAS No.21651-19-4/1344-28-1
Strontium titanate	SrTiO ₃			•	•			99.90%			CAS No.12060-59-2

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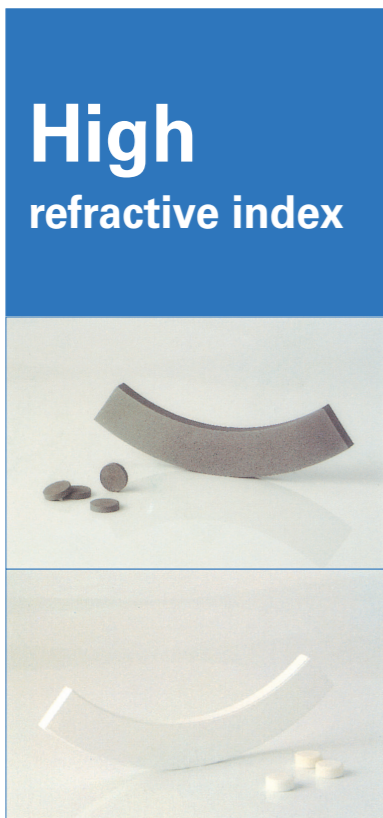
High refractive index



Evaporation material	Chemical Formula	Refractive Index at 550nm	Transparency Range	Shape			Melting Point ^o C	Purity	Typical Application	Recommended Evaporation Source	Risk and Safety Indication
				Granules	Tablets	Crystal granules					
Neodymium sesquioxide	Nd ₂ O ₃	1.79	0.4-2 μ m	•	•		1900	99.90%	Filter and HR coating	B(W, Mo), E	CAS No.1313-97-9
Gadolinium sesquioxide	Gd ₂ O ₃	1.8	0.32-15 μ m	•	•		2340	99.90%	Smooth and firm film applied to AR coating	RS, E	CAS No.12064-62-9
Samarium sesquioxide	Sm ₂ O ₃	1.8		•	•		2350	99.90%	Applied to electron gun evaporation, easy to lose oxygen in the evaporation process Firm, compact and smooth film	E	CAS No.12060-58-1
Scandium oxide	Sc ₂ O ₃	1.86	0.35-13 μ m	•	•		2300	99.90%	UV coating	E	CAS No.12060-08-1
Yttrium oxide	Y ₂ O ₃	1.87	0.3-12 μ m	•	•		2410	99.99%	Insulative coating	E	CAS No.1314-36-9
Silicon monoxide	SiO	1.8-1.9	0.4-9 μ m	•	•		1700	99.90%	Cold light coating Decorative coating Protective coating	B(Ta, Mo, W)	CAS No.10097-28-6
Titanium sesquioxide	Ti ₂ O ₃	1.9-2.3	0.4-12 μ m	•	•	•	1800	99.90%	AR coating Beam splitter Cold light coating Filter HR coating Glasses coating	RE, RS	CAS No.1344-54-3
Trititanium pentoxide	Ti ₅ O ₅	1.9-2.3	0.4-12 μ m	•	•		1750	99.90%	AR coating Beam splitter Cold light coating Filter HR coating Glasses coating	RE, RS	CAS No.12065-65-5
Titanium monoxide	TiO	1.9-2.3	0.4-12 μ m	•	•		1750	99.90%	AR coating Beam splitter Cold light coating Filter HR coating Glasses coating	RE, RS	
Titanium dioxide	TiO ₂	1.9-2.3	0.36-9 μ m	•	•		1850	99.99%	AR coating Beam splitter Cold light coating Filter HR coating Glasses coating	RE, RS	CAS No.13463-67-7
Zirconium dioxide+ Yttrium oxide	ZrO ₂ +Y ₂ O ₃	1.9		•	•			99.99%	Applied to electron gun to form compact and smooth film. Various ratios are available upon customers' request		CAS No.1314-23-4/1344-28-1
Praseodymium oxide	Pr ₆ O ₁₁	1.92-2.05	0.4-10 μ m	•	•		2125	99.90%	AR coating Polarized coating	B(W), E	CAS No.12037-29-5
Zirconium dioxide	ZrO ₂	1.97-2.05	0.25-9 μ m	•	•		2715	99.90%	Multi-layer coating AR coating Hard coating Glasses coating	E	CAS No.1314-23-4
Dysprosium sesquioxide	Dy ₂ O ₃	2.0		•	•		2340	99.90%		E	CAS No.1308-87-8
Nickel oxide	NiO	2.0-2.1		•	•		1990	99.99%		B(W), S	CAS No.1313-99-1
Stannic oxide	SnO ₂	2.0-2.1		•	•		1127	99.99%		B(W), E	CAS No.18282-10-5
Stannic oxide+ indium oxide	SnO ₂ +In ₂ O ₃	2.0	0.3-9 μ m	•	•		1127	99.90%	Conductive coating		CAS No.18282-10-5/1312-43-2 R48/20,S22
Zirconium dioxide+ Titanium dioxide	ZrO ₂ +TiO ₂	2.05-2.15	0.36-7 μ m	•	•		2200-2400	99.99%		E, B(W)	CAS No.1314-23-4/13463-67-7

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Evaporation material	Chemical Formula	Refractive Index at 550nm	Transparency Range	Shape			Melting Point ^o C	Purity	Typical Application	Recommended Evaporation Source	Risk and Safety Indication
				Granules	Tablets	Crystal granules					
Dichromium trioxide	Cr ₂ O ₃	2.1		•	•		2275	99.90%	Absorbing coating	B(W), E	CAS No.1333-82-0
Lanthanum titanate	LaTiO ₃	2.1	0.3-9 μ m	•	•		2200-2300	99.90%	Low temperature substrate to get multi-layer coating AR coating I Filter I Glasses coating	E, B(W)	
Columbium pentoxide	Nb ₂ O ₅	2.1-2.3	0.35-9 μ m	•	•		1530	99.99%	Filter and HR coating	E	CAS No.1313-96-8
Praseodymium titanate	PrTiO ₃	2.1	0.3-9 μ m	•			2200-2300	99.90%	Multi-layer coating I AR coating Glasses coating	E, B(W)	
Praseodymium dititanate	Pr(TiO ₃) ₂	2.2	0.3-9 μ m	•	•		2200-2300	99.90%	Low temperature substrate to get multi-layer coating AR coating		
Zirconium dioxide+ Tantalum pentoxide	ZrO ₂ +Ta ₂ O ₅	2.1		•	•			99.99%	Higher refractive index than ZrO ₂ .To form compact and smooth film. Resistant to chemical attack. Various proportions available to customers' request.		CAS No.1314-23-4/1314-61-0
Zinc oxide	ZnO	2.1	0.35-20 μ m	•	•		1975	99.90%	Conductive coating Infrared coating	B(W, Mo)	CAS No.1314-13-2
Hafnium oxide	HfO ₂	2.15	0.2-9 μ m	•	•		2812	99.99%	AR coating I HR coating I UV coating	E, RS	CAS No.12055-23-1
Tantalum pentoxide	Ta ₂ O ₅	2.16	0.35-9 μ m	•	•		1800		Filters I HR coating I Insulating coating	RE, RS	CAS No.1314-61-0
Cerium dioxide	CeO ₂	2.2	0.4-12 μ m	•	•		1950	99.99%	AR coating	B(W), E	CAS No.1306-38-3 I R22
Titanium dioxide+ Columbium pentoxide	TiO ₂ +Nb ₂ O ₅	2.2		•	•			99.99%	Applied to electron gun evaporation. Easy to handle. Various proportions are available upon customers' request.	E	CAS No.13463-67-7 /1313-96-8
Titanium dioxide+ Tantalum pentoxide	TiO ₂ +Ta ₂ O ₅	2.25-2.3		•	•			99.99%	Applied to electron gun evaporation. Easy to handle. Various proportions are available upon customers' request.	E	CAS No.13463-67-7/1314-61-0
Dysprosium trioxide	Sb ₂ O ₃	2.3	0.3-1 μ m	•	•		656	99.90%	AR coating	B(Ta, Pt)	CAS No.1327 -33-9
Vanadium trioxide	V ₂ O ₃	2.3	0.56-7 μ m	•	•		690	99.90%			CAS No.1314-34-7
Zinc sulfide	ZnS	2.35	0.4-14 μ m	•	•		1900	99.99%	Cold light coating I Decoration coating Filter HR coating I Infrared coating	B(Ta, Mo)	CAS No.1314-98-3
Bismuth trioxide	Bi ₂ O ₃	2.45(0.55 μ m) 2.2(9 μ m)	0.4-12 μ m	•	•		860	99.90%	AR coating	R(Pt), RS	Poisonous vapour
Cadmium sulfide	CdS	2.5	0.55-7 μ m	•	•		1750	99.90%	AR coating	B(Pt, Ta)	CAS No.1306-23-6
Cupric oxide	CuO	2.6		•	•		1326	99.90%		E	CAS No.1317-38-0
Iron trioxide	Fe ₂ O ₃	2.72		•	•		1565	99.90%		E	CAS No.1309-37-1
Cadmium+tellurium	CdTe	3.05	0.97-30	•	•		1041	99.90%	Infrared coating	B(Mo)	CAS No.7440-43-9/13494-80-9
Silicon	Si	3.4	1.0-9	•	•		1410	99.999%	Filter I AR coating I HR coating Laser coating	E, S	CAS No.7440-21-3
Cadmium+Selenium	CdSe	3.5		•	•		1350	99.99%		B(W)	CAS No.7440-43-9/7782-49-2

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