

Crucibles and Metal Liners for Thermal Evaporation

There are two primary considerations when selecting a crucible: chemical and thermal compatibility. There are a number of resources available on the web for determining crucible chemical compatibility of most common deposition materials. The following chart is one of them.

Thermal compatibility concerns the cracking of the crucible during evaporation. As molten materials conform to the shape of the crucible, differences in thermal expansion rates can cause the crucible to crack. There are several things you can do to avoid the cracking of your crucible:

- Use a metal liner. They can withstand the difference in expansion rates

If not using a metal liner:

- Limit the amount of material in the crucible so as not to cover the bottom
- Ensure that all material evaporates from out of the crucible before allowing it to cool
- Do not fill crucible more than $\frac{3}{4}$ full with non-subliming materials

Using a metal liner:

Some applications require a liner, including those evaporating materials that react with the crucible material itself and those in which the evaporating melting materials expansion rates are greater than that of the crucible material itself. You can purchase crucible liners made with the following materials:

Molybdenum
Tantalum
Tungsten
Nickel

Crucible Selection Guide

Material	Symbol	Crucible	Liner (if required)	Melt °C	S / D	NOTES
ALQ3	ALQ3	Organic				
Aluminum	Al	PBN		660		
Antimony	Sb	Alumina		631	S	O,T
Arsenic	As	Alumina		814	S	O,T
Barium	Ba	Alumina	Ta	717		O,P,T
Barium Chloride	BaCl ₂	Alumina	Ta, Mo	962		
Beryllium	Be	Alumina	W	1284		
Bismuth	Bi	Alumina	W, Ta, Mo	271		T
Boron Nitride	BN	Alumina		2973	S	
Cadmium	Cd	Alumina		321	S	P,T
Calcium	Ca	Alumina		810	S	O
Calcium Fluoride	CaF ₂	Alumina	Mo, Ta	1418		
Cerium	Ce	Alumina		785		H
Cesium Iodide	CsI	Alumina		621		
Chromium	Cr	Alumina	W	1857	S	
Cobalt	Co	Alumina		1478		
Copper	Cu	Alumina	Mo	1083		
Copper phthalocyanine	CuPC	Organic				
Dysprosium	Dy	Alumina	Ta	1409		
Erbium	Er	Alumina	Ta, W	1522	S	
Europium	Eu	Alumina		822	S	O
Gadolinium	Gd	Alumina		1312		
Gallium	Ga	Alumina		30		
Germanium	Ge	Alumina		959		
Gold	Au	Alumina		1063		
Holmium	Ho	Alumina	Ta	1470		
Indium	In	Alumina		157		
Indium Tin Oxide	ITO	Alumina		1800	S	
Iron	Fe	Alumina		1535		
Lanthanum	La	Alumina	Ta, W	887		O
Lead	Pb	Alumina		328		T
Lithium	Li	Alumina		179		H,O
Lithium Fluoride	LiF	Alumina	Ni	845		
Lutetium	Lu	Alumina		1656		
Magnesium	Mg	Alumina		651	S	O
Magnesium Fluoride	MgF ₂	Alumina		1261		
Manganese	Mn	Alumina		1244	S	
Neodymium	Nd	Alumina		1021		
Nickel	Ni	Alumina		1455		
Palladium	Pd	Alumina		1555	S	
Phosphorus	P	Alumina		597	S	T,F

Material	Symbol	Crucible	Liner (if required)	Melt °C	S / D	NOTES
Polonium	Po	Quartz		254		T
Potassium	K	Quartz		64		F
Potassium Bromide	KBr	Alumina		734		
Potassium Chloride	KCl	Alumina	Ni	770	S	
Potassium Iodide	KI	Alumina		681		
Praseodymium	Pr	Alumina	Ta	931		
Rubidium	Rb	Quartz		38		F
Samarium	Sm	Alumina		1072		O
Scandium	Sc	Alumina		1397		O
Selenium	Se	Coated SS		217		T
Silicon	Si	Alumina	Ta	1410		
Silicon Monoxide	SiO	Alumina	Ta	1702	S	
Silicon Nitride	Si ₃ N ₄	Alumina		1900		
Silver	Ag	PBN, Alumina	Mo	961		
Sodium	Na	Quartz		98		F
Sodium Fluoride	NaF	Alumina		993		
Strontium	Sr	Alumina	Mo, Ta, W	771		O,F
Sulfur	S	Quartz		597	S	P
Tellurium	Te	Alumina	Ta, W	450		T
Terbium	Tb	Alumina		1360		
Thallium	Tl	Alumina		304		T
Thullium	Tm	Alumina		1545	S	
Tin	Sn	Alumina		232		
Tin Oxide	SnO ₂	Alumina		1630	S	
Titanium Oxide	TiO	Alumina	W, Mo			
Tungsten Oxide	WO ₃	Alumina		1473	S	
Victawet	VW	Alumina				
Ytterbium	Yb	Alumina	Ta	824	S	
Yttrium	Y	Alumina		1477		
Zinc	Zn	Alumina		419	S	P

NOTES:

H = Hygroscopic films

O = Oxidizes quickly in air

T = Toxic

F = Flammable in air

P = Poisonous to vacuum systems due to low sticking coefficient

S = Sublimes

D = Decomposes