Crucible Liners

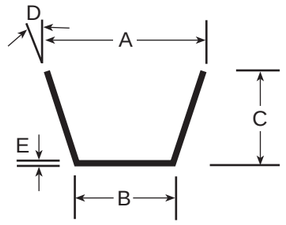
Handling

Maximizing the life of a crucible liner requires careful attention to handling and storage. Never handle liners with bare hands. Liners should be handled with gloves, tongs or finger cots. Graphite, coated graphite and FABMATE liners ***should not be cleaned with chemicals or solvents of any kind.*** Used liners should be stored in a dry, ***oxygen-free environment***.

Special Orders

Thermionics can provide crucible liners for most e-Gun applications. If your requirement is not met with the selection offered in this catalog please let us know. The following table outlines the information we require to quote non-standard liners, and can also help in determining your exact crucible type.

Crucible Liner Dimensional Reference



Description	Required Dimensions
(A) Top Diameter	
(B) Bottom Diameter	
(C) Height	
(D) Wall Angle	
(E) Wall Thickness*	
Material—*see Table*	
Quantity	

** This is an optional number*

Better Utilization of Liners

Proper technique is important, otherwise crucible liners will break due to thermal shock. Breakage, however, can be minimized. In addition, some materials become highly reactive when molten and may alloy to the liner.

The most common cause of crucible liner breakage is overfilling. Overfilling a liner can cause the evaporant material to "spill over" the liner onto the water-cooled crucible surface. This causes an increased thermal stress across the liner and in most cases will cause it to crack or shatter.

Liners should be filled with evaporant material at a level of no less than 25% volume and no more than 80% volume. Aluminum has a tendency to "wet" most liner materials and requires a reduced maximum charge level of 70%. Aluminum becomes highly reactive when molten and as a result will eventually react with any material.

Start-Up Operation Using a Crucible Liner

When beginning an evaporation run and using a crucible liner, care must be taken to increase the emission current (beam power) slowly. The evaporant material and liner will, in most cases, contain impurities and/or trapped gases that will be released as the temperature is increased.

If the temperature is increased too quickly this outgassing process can cause eruptions in the evaporant material. Increase power slowly, stopping whenever the oscillations in the melt occur, until achieving thermal equilibrium. The power required to evaporate materials from a liner are typically on the order of 25% of the total power required in a bare crucible (75% less, i.e.: 1 ampere without liner vs. 250 milliamperes with liner).

thermionics laboratory, inc.

www.thermionics.com
E-MAIL: sales@thermionics.com

thermionics laboratory, inc.

Crucible Liners

For e-Guns™ and Other Electron Beam Evaporation Sources

- Higher evaporation rates
- Reduced contamination
- Higher yield
- Improved performance
- Reduced thermal gradient
- Thermal isolation
- Thermal stability
- Lower power requirements
- Reduced maintenance
- Reduced crucible damage
- Liners for all manufacturers' sources

An Assortment of Crucible Liners

Crucible Liners and e-Gun Electron Beam Evaporation

Crucible liners are used with electron beam evaporation sources in applications throughout the coating industry. Crucible liners are widely accepted as part of the coating process, and are considered to be an integral component for coating success. Liners provide many advantages, for example:

When you select the right crucible liner for your evaporation source you will improve its performance and simplify your coating process. Using separate liners for each evaporant material will reduce contamination, by eliminating the need to clean the evaporation source crucible even when performing routine material changes.

Crucible liners provide thermal isolation between the evaporant material and the water-cooled crucible. Therefore, the evaporation process requires less power, and you will achieve:

1. higher evaporation rates at the same power level, or
2. the same evaporation rate at a lower power level.

Crucible liners reduce the thermal gradient across the evaporant material. This increases the thermal stability within the melt, thereby increasing heating efficiency and reducing particle ejection and oscillations within the molten material.

Crucible liners also provide extra protection against crucible damage.

© 2024 Thermionics
Trademarks are acknowledged

Material Selection Guide

The following table provides a list of common evaporation source materials and makes general recommendations for compatible liner materials. This selection guide has been derived from various sources and is based upon specific cases; results may vary with your application. A more comprehensive list of evaporation source and liner materials is available upon request.

Crucible Liner Material Selection Guide

EVAPORANT MATERIAL	LINER MATERIAL: Standard Graphite -G	Glassy Coated Graphite -CG	FABMATE® -FM	Copper -CU	Alumina -AL	Boron Nitride -BN	Molybdenum -MO	Tantalum -TA	Tungsten -W
Aluminum		X	X			X			
Antimony	X				X	X			
Barium				X			X	X	X
Beryllium		X	X						
Boron		X	X						
Cerium		X	X		X				
Chromium		X	X						
Cobalt					X				
Copper					X		X	X	
Gallium					X				
Germanium					X				
Gold		X			X	X			
Indium							X		
Iron					X				
Lead					X				
Magnesium					X				
Neodymium					X				
Nickel		X			X				
Palladium					X				
Platinum		X							
Rhodium		X							
Samarium					X				
Selenium		X			X				
Silicon		X	X					X	
Silver					X		X		
Strontium		X							
Tin					X			X	
Yttrium					X				
Zinc					X				

Liner Materials

Crucible liners are available in various materials. Carbon graphite and glassy coated carbon graphite are two of the more common materials used. They are popular due to their low cost and favorable thermal properties.

Carbon graphite is a fine grain, high density polycrystalline material with interconnecting porosity. It can be purified to 5 ppm or less. The glassy coated carbon graphite liners are made from the same high grade carbon with a coated graphite process that is baked above 1,400°C to eliminate any porosity in the carbon.

FABMATE crucible liners are an alternative to the glassy coated graphite. FABMATE receives an amorphous carbon treatment to provide a hard, abrasion resistant, non-porous surface.

Other crucible liner materials include Alumina, Boron Nitride, Copper, Molybdenum, Tantalum and Tungsten. Liners made from these more exotic materials are more expensive and typically limited to special applications.

3118 Depot Rd., Hayward, CA 94545

thermionics laboratory, inc.

www.thermionics.com
E-MAIL: sales@thermionics.com

Ordering Information

Crucible Liner Material Suffix Chart

Dash Suffix	Description
-G	Standard Graphite
-CG	Glassy Coated Graphite
-FM	FABMATE
-CU	Copper
-AL	Alumina
-BN	Boron Nitride
-MO	Molybdenum
-TA	Tantalum
-W	Tungsten

To Determine Correct Model Number

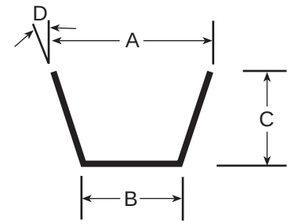
A111 _ _ _ - _ _

Model No. Prefix — Liner Material *(see table to the left)*

EXAMPLE

A111368-G identifies a standard graphite, 40 cc liner

Crucible Liner Dimensional Reference



Description
(A) Top Diameter
(B) Bottom Diameter
(C) Height
(D) Wall Angle

3 kW e-Gun Sources

Model No.	Description e-Gun Application	(A) Top Diameter	(B) Bottom Diameter	(C) Height	(D) Wall Angle
A111460- X X	TLI New style, 2.2 cc 3 kW e-Gun liner. All models	.75”	.56”	.37”	15°
A111455- X X	TLI Old style, 1.5 cc 3 kW single pocket e-Gun liner	.70”	.33”	.32”	30°
A111449- X X	TLI Old style, 1.5 cc 3 kW multi-pocket e-Gun liner	.78”	.36”	.36”	30°
A111541- X X	Varian style 2 kW single pocket e-Gun	.75”	~1/8”	.16”	30°
A111542- X X	Varian style 2 kW multi-pocket e-Gun	.75”	~1/8”	.16”	30°

6 to 15 kW e-Gun Sources

Model No.	Description e-Gun Application	Compatible Manufacturers	(A) Top Diameter	(B) Bottom Diameter*	(C) Height	(D) Wall Angle
A113101- X X	7 cc crucible liner	Temescal, Varian	1.16”	.87”	.56”	15°
A111959- X X	10 cc crucible liner		1.28”	.87”	.75”	15°
A111962- X X	15 cc crucible liner	Temescal, Telemark	1.48”	1.12”	.67”	15°
A111677- X X	25 cc crucible liner	Temescal, Telemark	1.75”	1.30”	.83”	15°
A111368- X X	40 cc crucible liner	Temescal, Sloan	2.00”	1.49”	1.06”	15°
A111675- X X	75 cc crucible liner		2.50”	1.83”	1.25”	15°
A111466- X X	156 cc crucible liner	Temescal	3.25”	2.44”	1.56”	15°
A111676- X X	100 cc crucible liner		2.75”	2.01”	1.38”	15°
A111967- X X	10 cc to 4 cc reducing liner		1.25”	.89”	.68”	15°
A111464- X X	15 cc to 10 cc reducing liner	Temescal, Telemark	1.50”	1.16”	.75”	15°
A111369- X X	40 cc to 15 cc reducing liner	Temescal, Sloan	2.00”	1.52”	1.10”	15°

**Dimensions given are approximate.*

NOTE: All crucible liners listed are compatible with Thermionics e-Gun evaporation sources. Some crucible liners are marked as compatible with specific manufacturer's evaporation sources.

thermionics laboratory, inc.

www.thermionics.com
E-MAIL: sales@thermionics.com