



24cc High Temperature Source

## High Temperature Source

- For temperatures up to 2000°C in UHV
- Sources available for multi-wafer 4" systems
- Oxidation-resistant source construction
- User replaceable heat shielding and filaments
- More than 425 sources in the field

### Description

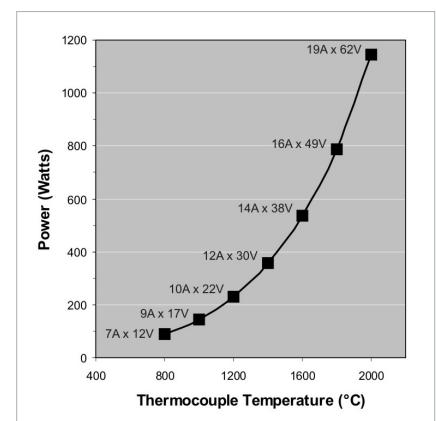
The Veeco High Temperature Source provides thermal evaporation of charge materials at temperatures up to 2000°C. This compact MBE source operates efficiently to achieve high temperatures without excessive thermal load on the system. Low power requirements also enhance the lifetime of the heater filaments.

The hot zone is constructed exclusively of refractory tungsten and tantalum to ensure clean operation in UHV, even at the highest operating temperatures. The tungsten heater filaments, as well as the heat shielding at the orifice, are field replaceable. Insulating ceramics such as PBN are restricted to cooler regions of the source to prevent outgassing during operation.

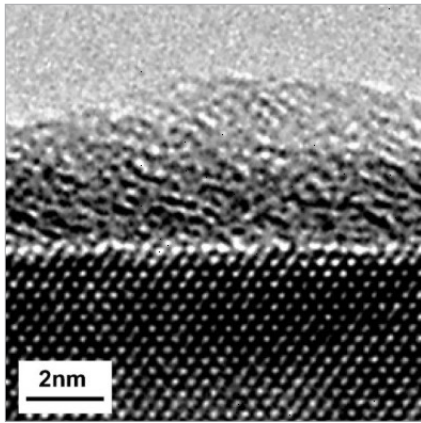
High Temperature Sources are available in a number of sizes based on the capacity and performance required:

- **6cc and 10cc straight-wall.** Best suited for use with small (2") substrates and partial wafers.
- **24cc conical.** Charge capacity and flux uniformity suitable for deposition on 3" and larger substrates.
- **26cc SUMO.** As with all SUMO crucibles, this source offers the largest available capacity, excellent flux uniformity, long-term flux stability, and efficient source operation for deposition on 3" and larger substrates.
- **78cc conical.** Largest capacity for deposition on multi-4" or single-8" systems.

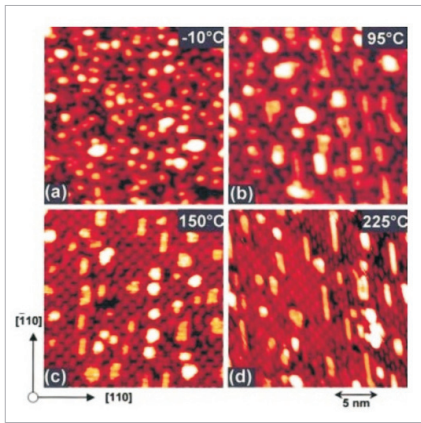
Crucibles are available in refractory metal and ceramic materials. The appropriate choice will vary with the desired evaporant material. Reactive materials are often evaporated from a metal crucible combined with a ceramic liner. The SUMO design is not available in all crucible materials due to manufacturing constraints.



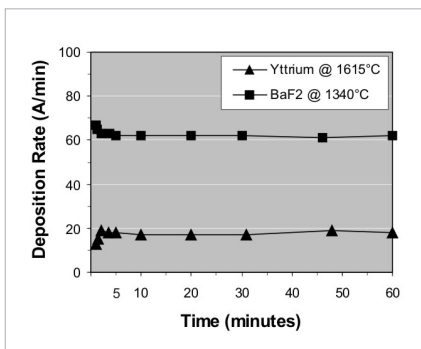
Power consumption for an empty 10cc High Temperature Source. Actual results are usually lower because the crucible acts as a heat shield for the filament.



Cross-sectional HRTEM image of 10Å of amorphous LaAlO<sub>3</sub> on (001) Si showing no interfacial layer between the LaAlO<sub>3</sub> film and silicon.<sup>1</sup>



Filled state STM image obtained after deposition of 0.25ML of Co on GaAs(001) c(4x4) surfaces at substrate temperatures of (a) -10, (b) 95, (c) 150, and (d) 225°C. (All images are 20nm X 20nm.)<sup>2</sup>



Example of BEP stability provided by Veeco High Temperature Source.<sup>3</sup>

## Performance and Benefits

Advantages of the Veeco design include:






- **Optimized Heater Filament.** Uniform heating over the length of the crucible produces a more consistent flux over the lifetime of the source charge. The heater filament has proven to be very durable.
- **Oxidation-Resistant Construction.** For reliability even during oxide deposition, the use of tantalum is avoided in the hottest regions of the source.

Demonstrated applications include:

- La for LaAlO<sub>3</sub> growth as an alternative to SiO<sub>2</sub> in Si-based MOSFETs.
- B as a dopant in Si MBE (up to 1x10<sup>20</sup>cm<sup>-3</sup>).
- BaF<sub>2</sub> and CaF<sub>2</sub> in high T<sub>c</sub> superconducting thin films and insulating epitaxial layers.
- Cu, Dy, Er, and Y for high T<sub>c</sub> superconducting thin films and doping of III-V materials.
- Co, Cr, Fe, Ni, Pd, La, Ti and other materials for a variety of metal thin films.

1. L.F. Edge, D.G. Schlom, R.T. Brewer, Y.J. Chabal, J.R. Williams, S.A. Chambers, C. Hinkle, G. Lucovsky, Y. Yang, S. Stemmer, M. Copel, B. Holländer, and J. Schubert. "Suppression of subcutaneous oxidation during the deposition of amorphous lanthanum aluminate on silicon", Appl. Phys. Lett. 84(22), 2004.
2. K. Lüdge, B. D. Schultz, P. Vogt, M. M. R. Evans, W. Braun, C. J. Palmstrom, W. Richter, and N. Esser, "Structure and interface composition of Co layers grown on As-rich GaAs(001) c(4x4) surfaces", J. Vac. Sci. Technol. B, 20, 1591, (2002).
3. E. Coleman, T. Siegrist, J.J. Yeh, "Preparation of high T<sub>c</sub> (Tb,T) Ba<sub>2</sub>Cu<sub>3</sub>O thin films by co-evaporation from sources", J. Elect. Mats. 19 (1990) 235-239.

## Product Specifications

Source Characteristics	6cc	10cc	24cc	26cc SUMO	78cc
<b>Charge Materials</b>	For use with low vapor pressure materials which are evaporated or sublimed in the temperature range of 1300-2000°C. With some evaporants, source operation may be limited to temperatures well below 2000°C due to interactions with available crucible materials. Contact Veeco to discuss your specific application				
<b>Crucible Type</b>					
<b>Filament Type</b>	Single filament (field replaceable self-supporting tungsten wire filaments)				Dual filament (field replaceable self-supporting tungsten wire filaments)
<b>Minimum Mounting Flange Size</b>					
<b>Standard</b>	2.75"/70mm		4.5"/114mm		Contact Veeco
<b>With Water-Cooling</b>	4.5"/114mm				
<b>Thermocouple Type</b>	One Type C (W/Re 5/26%) non-contacting thermocouple				
<b>In-Vacuum Length</b>	Minimum 9"/229mm Maximum 14"/356mm		Standard 13.5"/343mm Adapter nipple used to correct in-vacuum length		Contact Veeco
<b>In-Vacuum O.D.</b>	Standard 1.5"/38mm With Water-Cooling 2.2"/56mm		Standard 2"/51mm With Water-Cooling 2.7"/69mm		Contact Veeco
<b>Typical Operating Temperature</b>	1300-2000°C				
<b>Maximum Outgassing Temperature</b>	2000°C				1900°C
<b>Water-Cooling</b>	Standard for VG systems and multi-wafer systems. Optional for all other systems				
<b>Power Supply</b>	One Veeco Auto-Ranging DC Power Module is recommended				Two Veeco Auto-Ranging DC Power Modules are recommended
<b>Options</b>	Integral water-cooling, integral source shutter				
<p><b>Please note—Product specifications above are for standard sources. Oxygen and ammonia compatible source designs are also available, contact Veeco for more information.</b></p>					

\* Dimensions listed are for tungsten crucibles. Dimensions for other crucible materials may vary.

## Selection Guide

System		Typical Source Commonly Used Indicated By "X"				
		6cc	10cc	24cc	26cc	78cc
Veeco	GEN II	X	X			
	MOD GEN II / GEN III	X	X	X	X	
	930 / GEN930	X	X	X	X	
	GEN10	X	X	X	X	
	GEN20	X	X	X	X	
	GEN200			X	X	X
	GEN2000					
Riber	32	X	X			
	Compact 21	X	X	X	X	
	Epineat	X	X	X	X	
	48 / 49			X	X	X
	6000 / 7000					
VG Semicon	V80	X	X			
	V90	X	X	X	X	
	V100			X	X	X
	V150					
Perkin-Elmer	X	X	X	X		
Other	Veeco sources are also available for use on systems from Eiko, Anelva, Ulvac, SVTA, and DCA, as well as custom chambers. Contact Veeco for details.					

Crucibles and Liners		Part Number				
		6cc	10cc	24cc	26cc	78cc
Crucible Material	W	201202	200781	211018	—	227705
	PBN	201201	202357	211619	210933	227706
	PG	202018	203097	211144	211161*	227707
	Al <sub>2</sub> O <sub>3</sub>	207061	203027	211752	—	227708
	BeO	202495	202192	211753	—	227709
	Ta	209605	490151	210925	211175	226827
Liner Material	Al <sub>2</sub> O <sub>3</sub>	201435	201126	211620	—	227710
	PG	201203	200945	211621	—	227711
	BeO	204865	203012	211622	—	227712
	ZrO <sub>2</sub>	201528	204527	212593	—	227713
Other	Crucible/liner materials may be available. Contact your Veeco Sales Representative to discuss your specific application.					

\* Only available in standard graphite.



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