PennState College of Engineering

CENTER FOR NANOTECHNOLOGY EDUCATION AND UTILIZATION

Evaporator

How It Works:

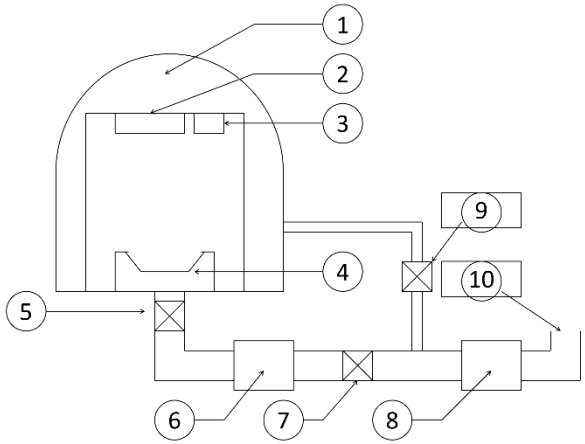
The process of evaporation starts with metals in a solid state. These source metals are heated in a tungsten crucible to a liquid state and then to a gaseous state. They rise to the substrate where they cool and are deposited.

Tool Operation:

Metals can be evaporated in two different ways. The first is thermal evaporation where current flows through a tungsten boat that holds the metal to be deposited. The current heats the boat and melts the metal. Thermal evaporation can only be used on low melting point metals. The second form of evaporation is electron beam evaporation. In e-beam evaporation a high melting point filament has current run through it. Electrons from the filament are excited by the current and pour off of the filament. A series of magnets focus and direct the e-beam to a crucible which holds the metal to be deposited. The metal then evaporates tot the substrate where it cools and is deposited.

Material / Applications:

Many materials can be deposited via evaporation. The list includes Aluminum, Copper, Gold, Platinum, and Chromium.



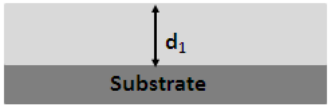
1	Steel chamber	6	Mechanical pump
2	Target holder	7	Foreline valve
3	Crystal thickness monitor	8	Turbo pump
4	Crucible	9	Rough vlave
5	High Vacuum valve	10	Exhaust

Cooke Thermal Evaporator Specifications

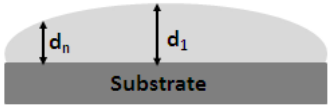
System Base Pressure:	8.0×10^{-6} T
Typical Operation Pressure:	5.5×10^{-5} T
Max number of boats:	3
Evaporation current:	100 Amp or 300 Amp
Low vacuum pump:	Mechanical Oil Pump
High vacuum pump	Turbo Molecular Pump
Ultra high vacuum pump	Titanium Sublimation Pump
Types of materials that can be deposited:	Low melting point metals. i.e. Al, Au, Ag

Uniformity of Deposited Layers

A comparison of an ideal uniform thin film (left) to a more realistic thin film (right). The dimension d_1 is representative of the film thickness obtained directly above the point source. The dimension d_n is representative of the film thickness at any other location not perpendicular to the point source.



Ideal Uniform Thin Film



Experimental Thin Film