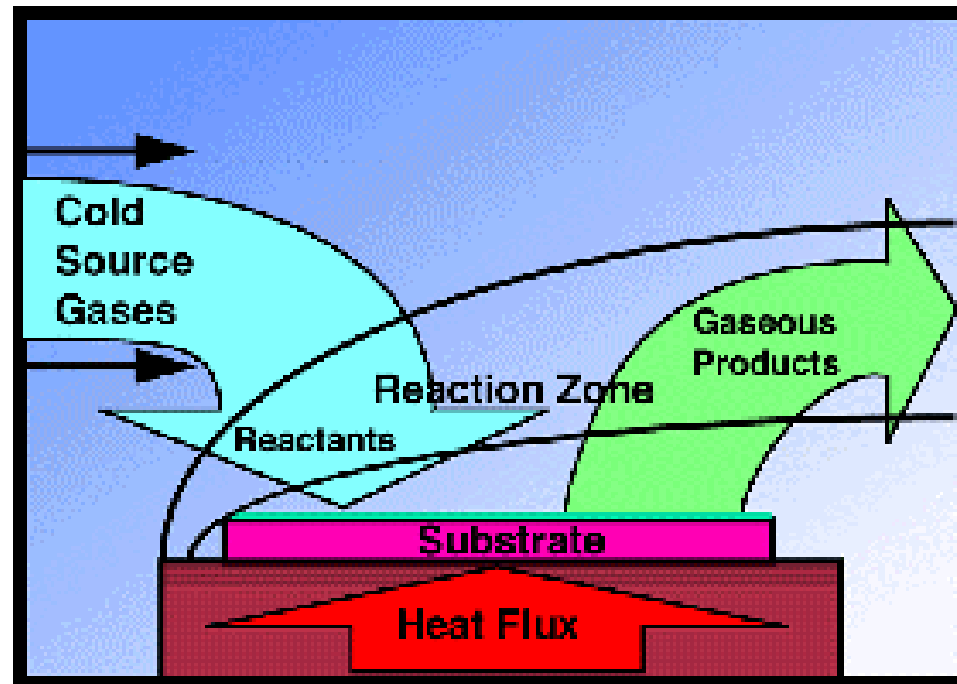


Chemical Vapor Deposition

- A process wherein chemically reactive gases are used to deposit a thin film on a solid substrate
- CVD requires some sort of energy input to dissociate the precursors to form reactive intermediates that deposit on the substrate.

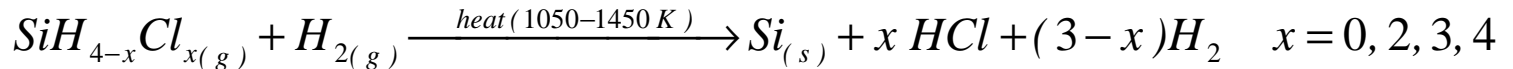


Jargon of CVD:

Classification by “source of energy input”

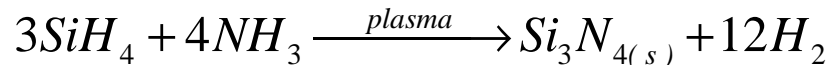
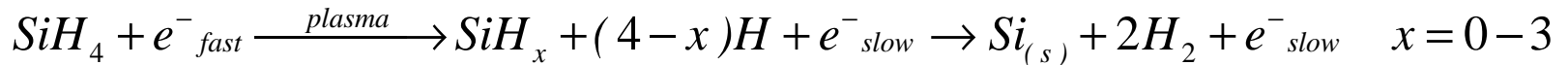
(1) Thermal Chemical Vapor Deposition (CVD)

- heat the gas and/or the substrate



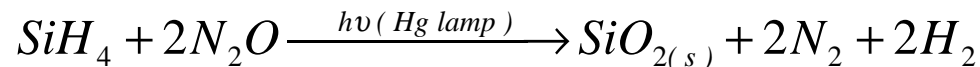
(2) Plasma Enhanced Chemical Vapor Deposition (PECVD)

- excitation by electrons in a plasma where the electrons are accelerated by an electric field



(3) Photolytic CVD

- excitation by light source, laser or broadband



CVD Classification by pressure regime

- (1) Atmospheric pressure CVD (APCVD) (760 Torr)
- (2) Subatmospheric CVD (10s of Torr to 760 Torr)
- (3) Low pressure CVD (LPCVD) (0.01-10 Torr)
- (4) Ultra High Vacuum CVD (UHV-CVD)
 - The lowest pressure the chamber can reach is $\sim 10^{-9}$ Torr but depositions are done 10^{-6} - 10^{-3} Torr



CVD Classification by gas precursor / film structure / growth mechanism

(1) Metalorganic CVD (MOCVD)

- Gas precursors are low boiling point organometallic liquids or solids that can be sublimed w/o decomposition

(2) Epitaxy or Vapor Phase Epitaxy

- For growing low defect density single crystal layers
- Homoepitaxy: (film and substrate are the same material)
- Heteroepitaxy: (film and substrate are different materials)

(3) Nonepitaxial growth

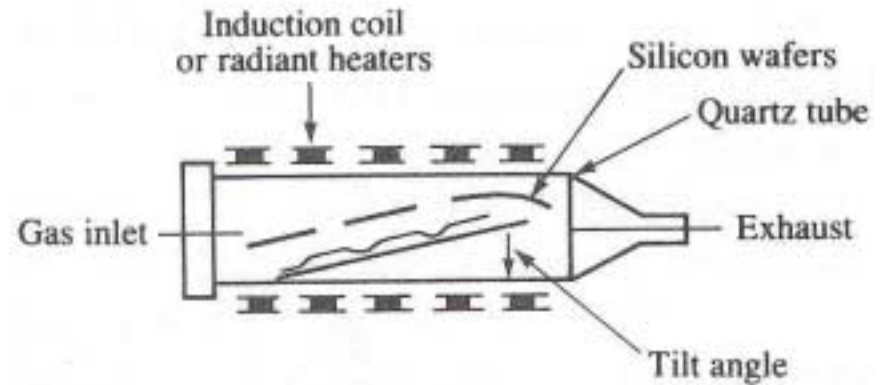
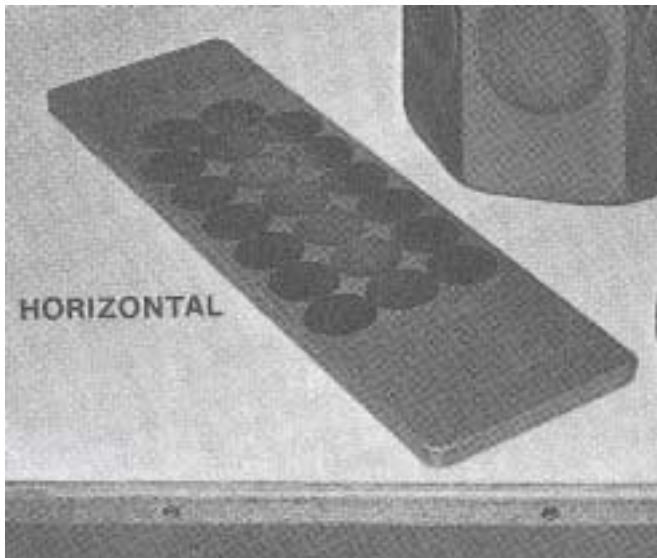
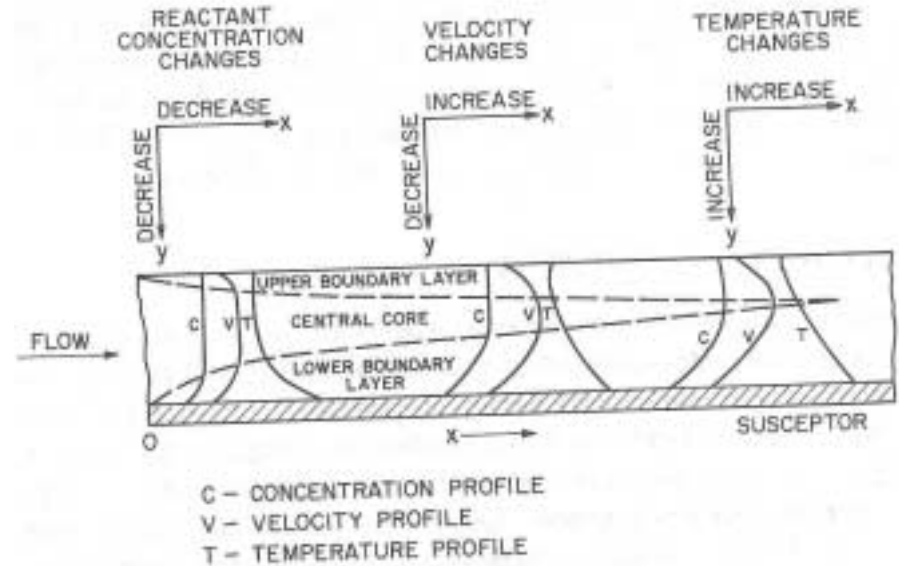
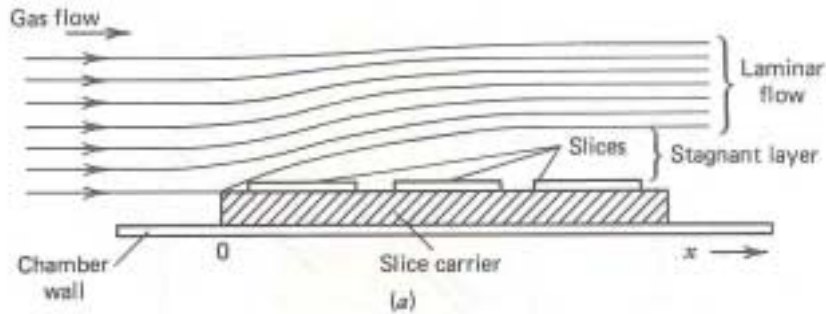
- Polycrystalline or amorphous films

(4) Atomic Layer Deposition (ALD) or Atomic Layer Epitaxy (ALE)

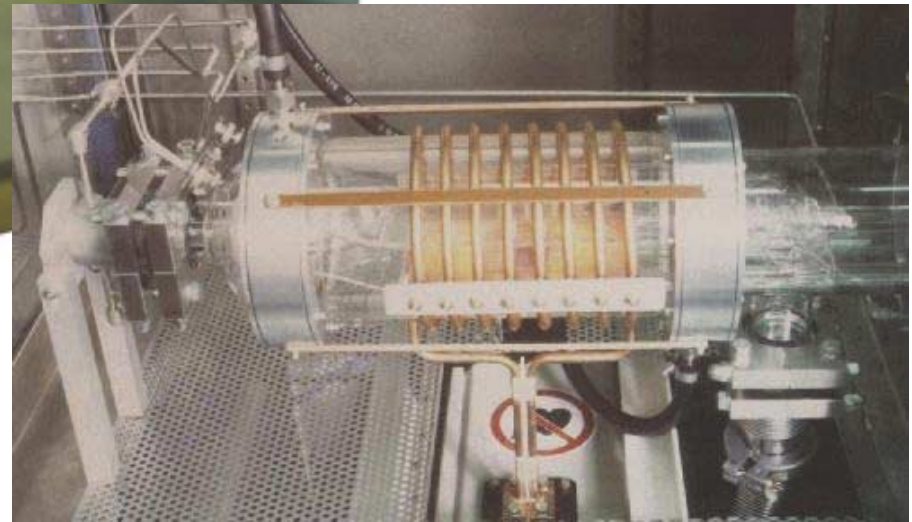
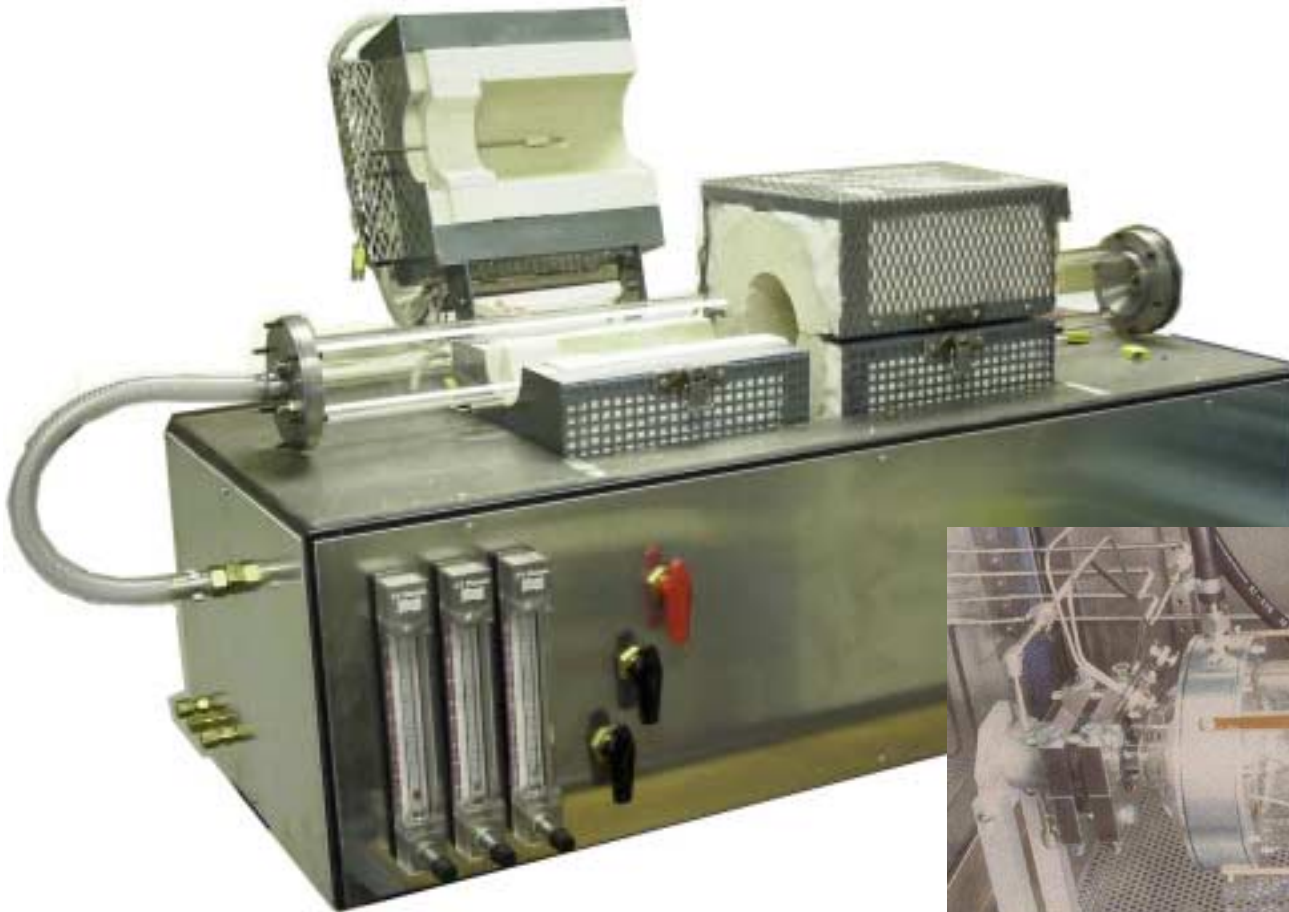
- Growing the films one atomic layer at a time
-



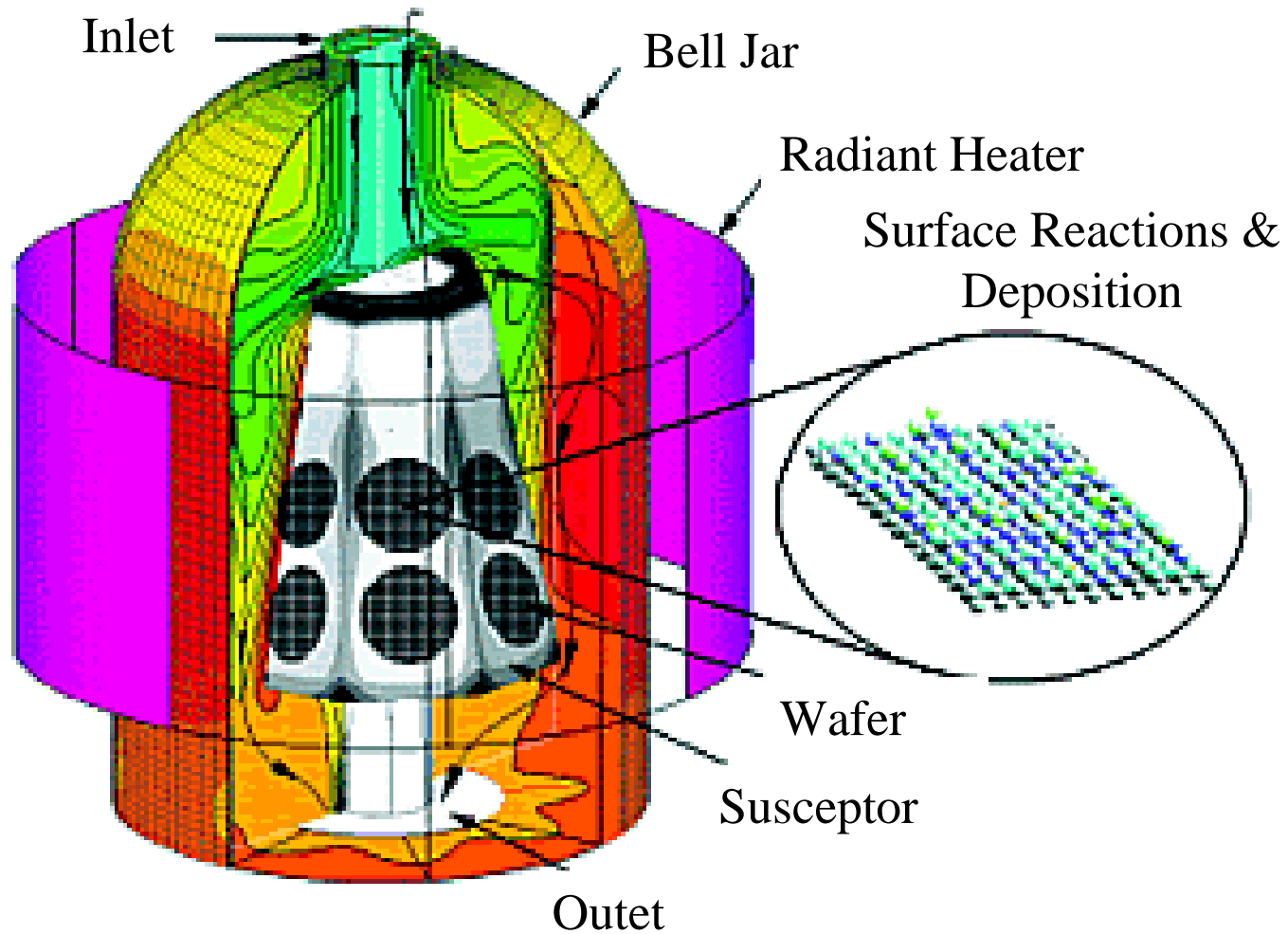
Horizontal CVD Reactors



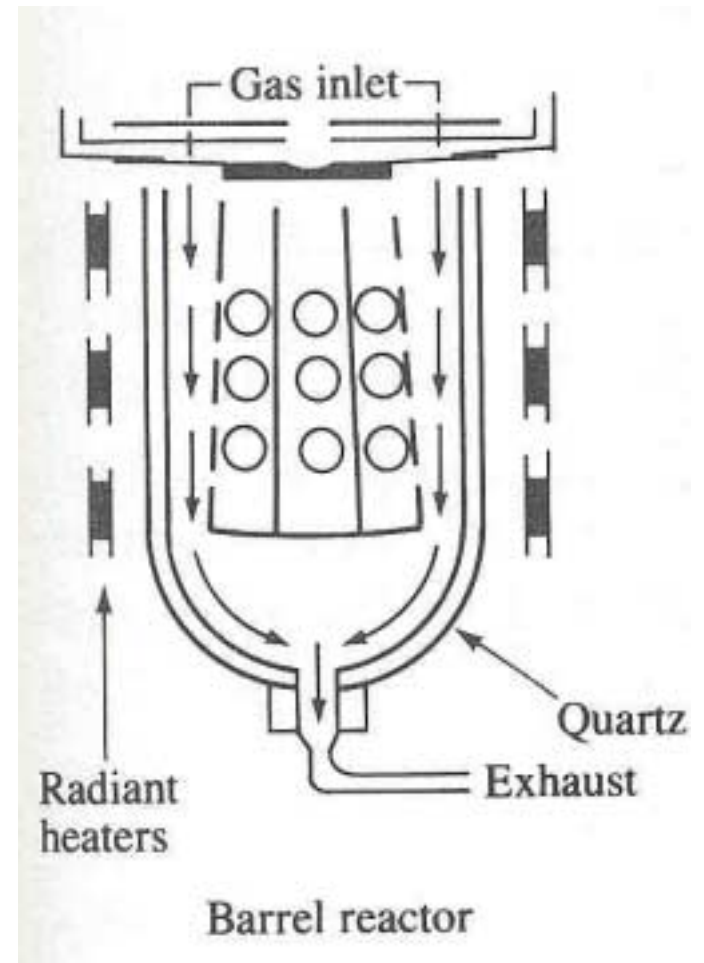
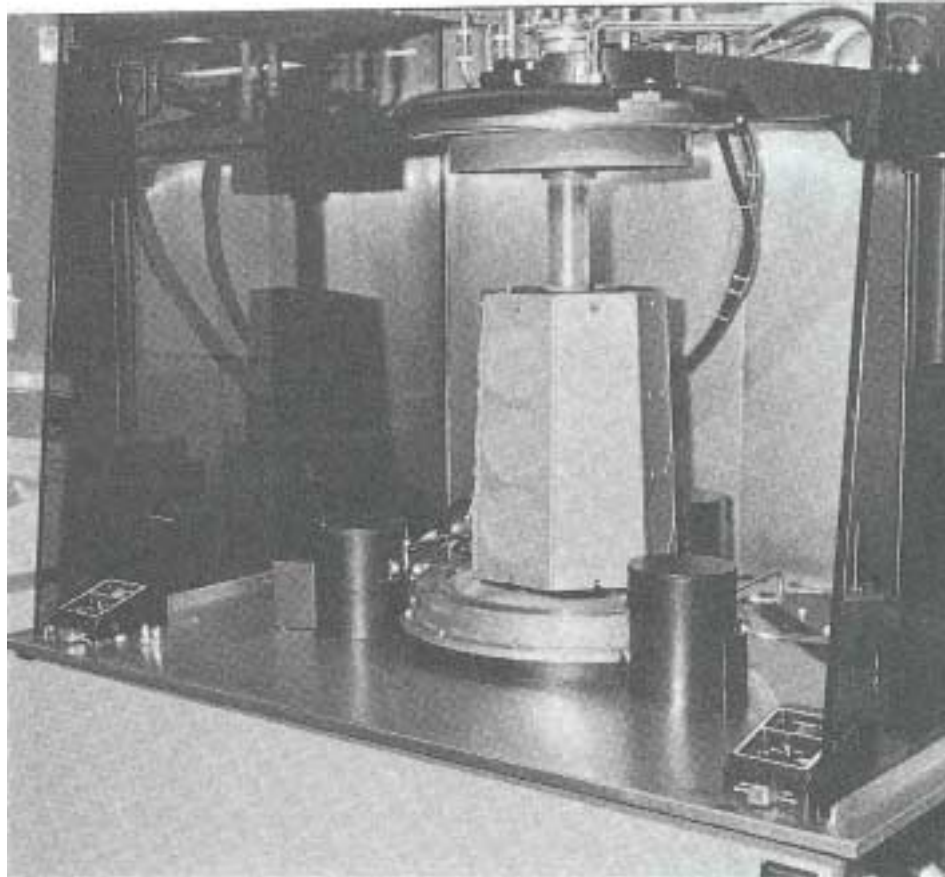
Horizontal CVD Reactors



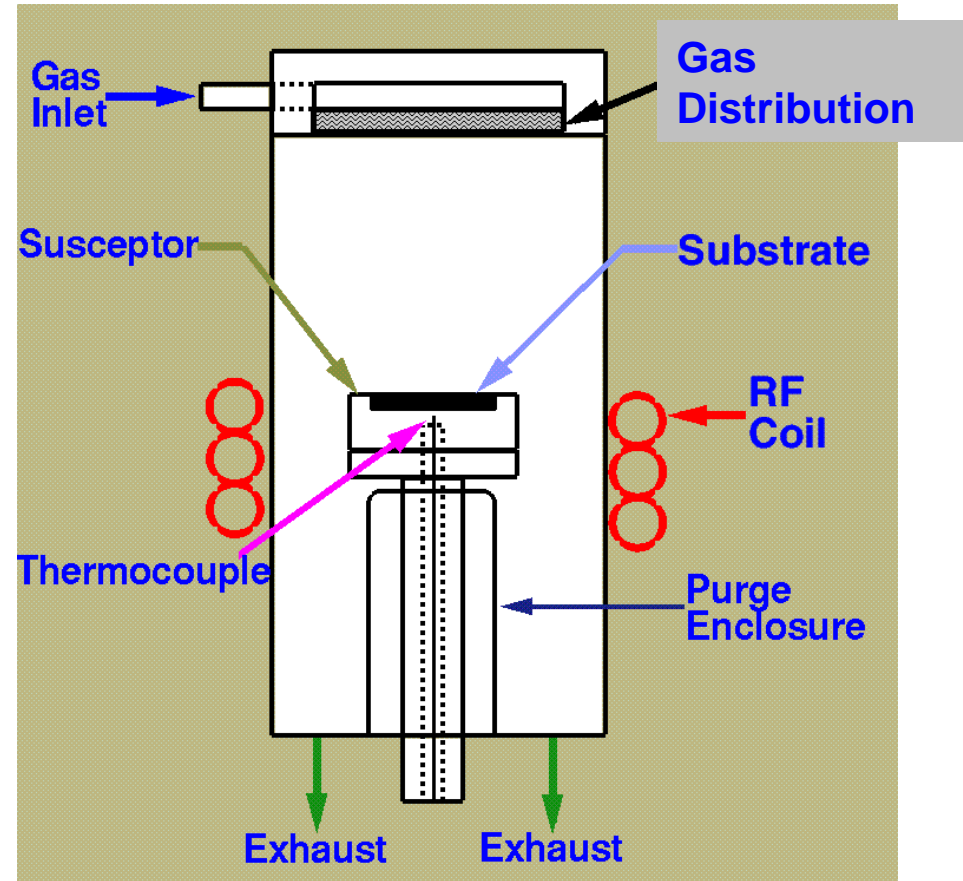
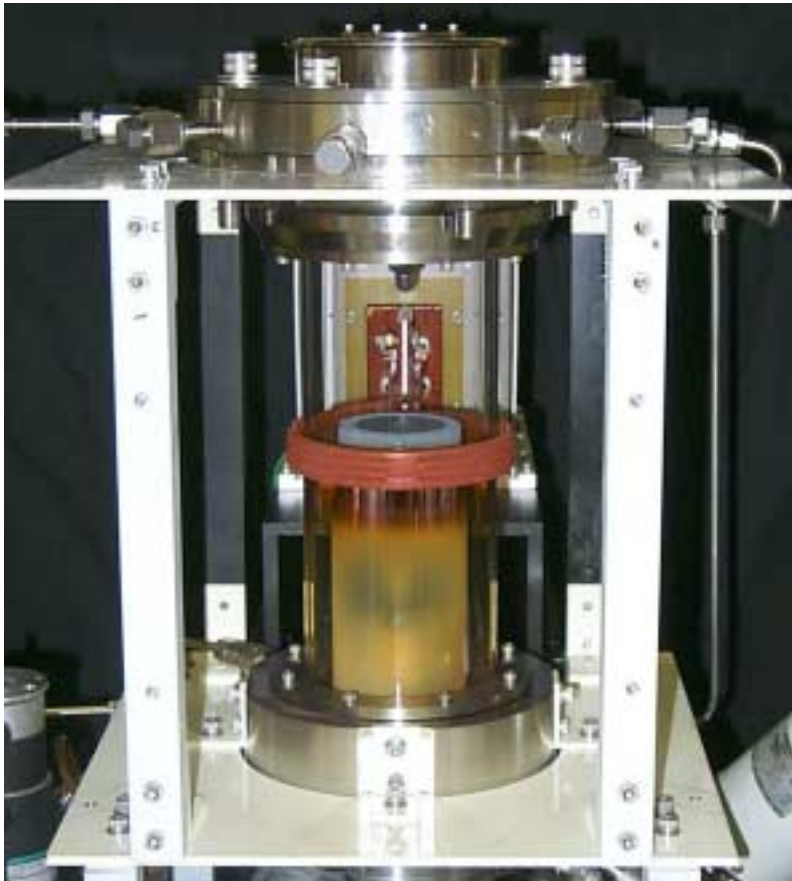
The Barrel Reactor



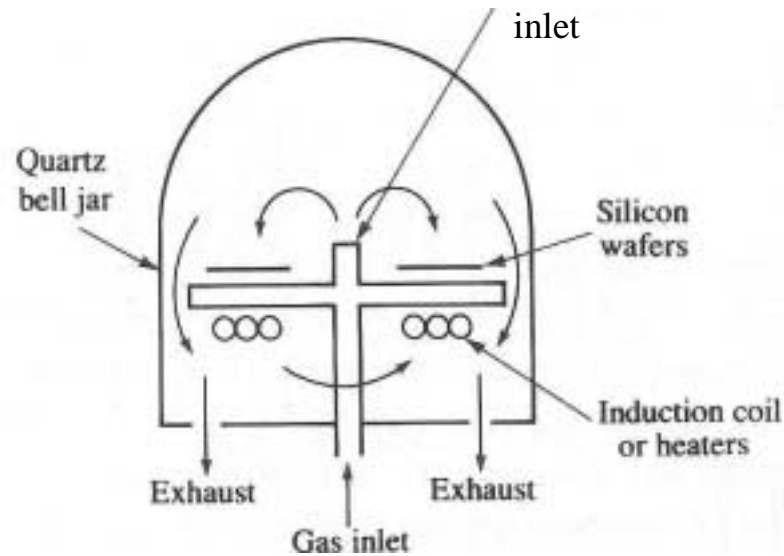
The Barrel Reactor



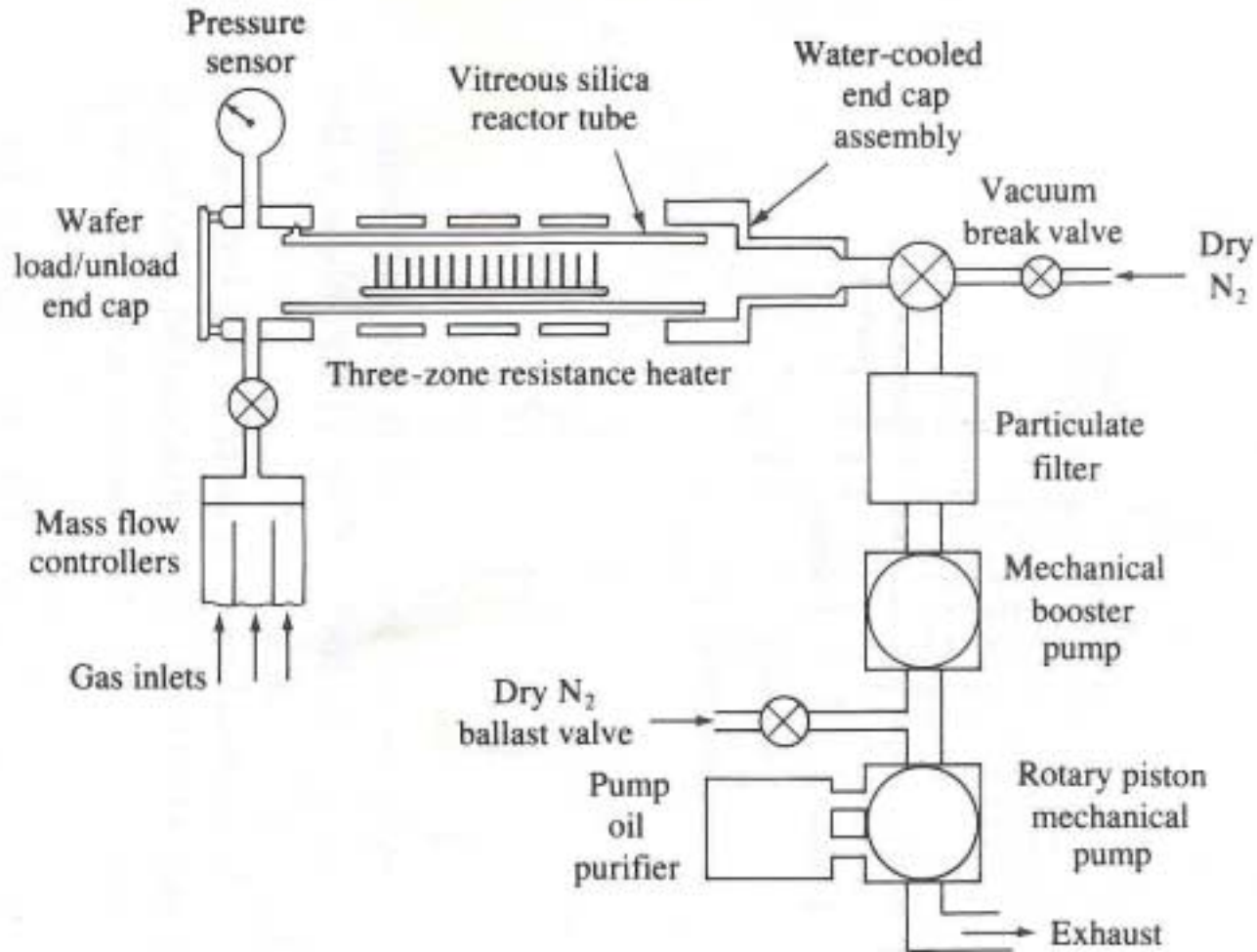
(Rotating Disk) Vertical CVD Reactor



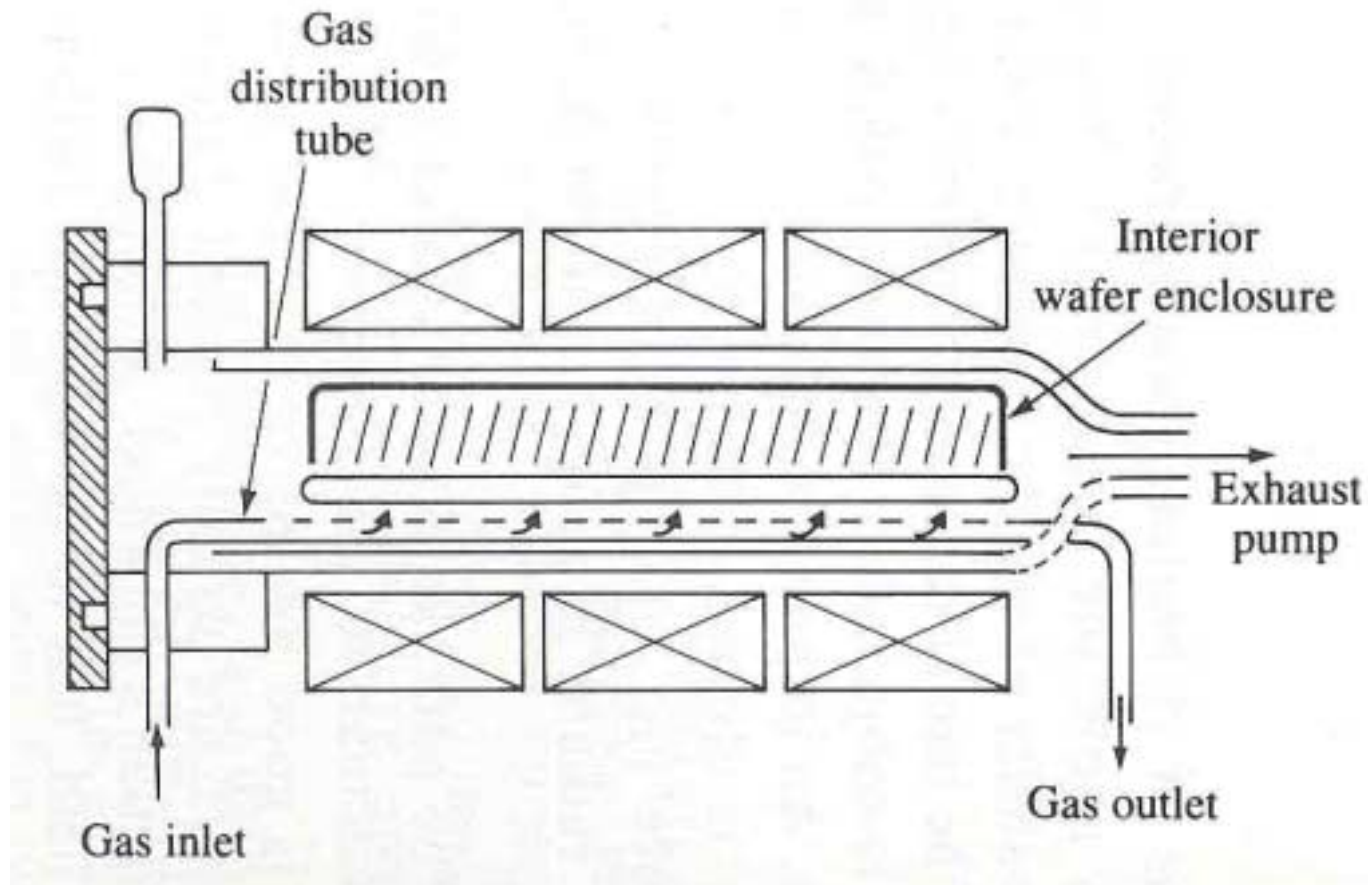
Pancake or Planetary CVD Reactor



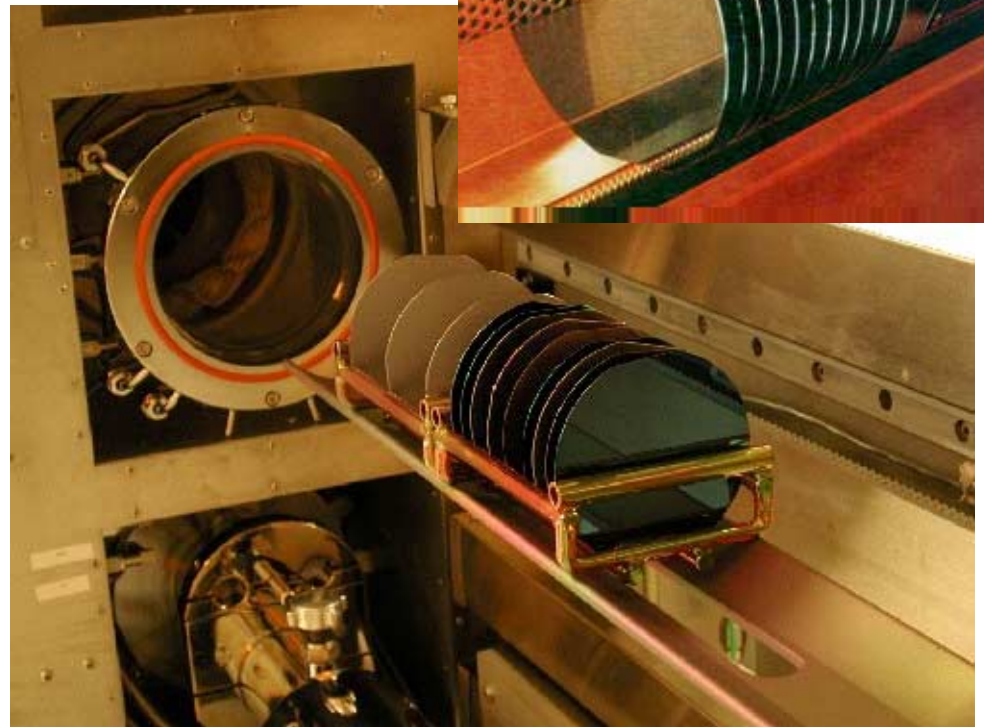
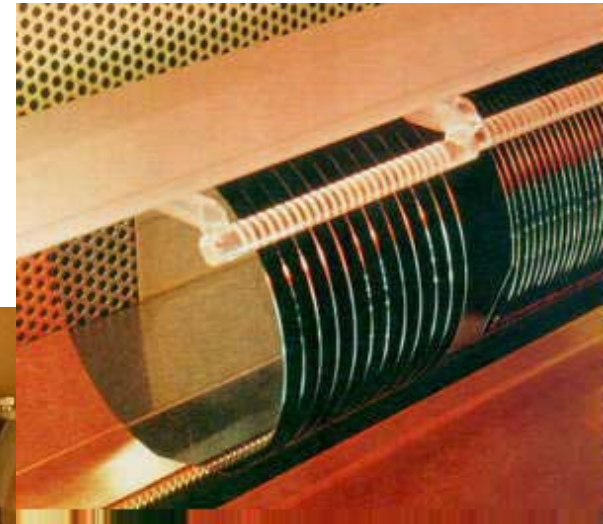
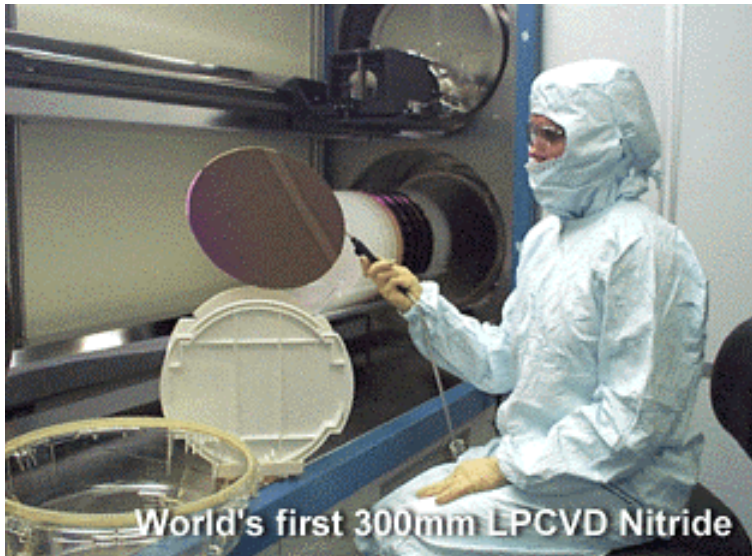
LPCVD Reactor



Distributed Feed LPCVD Reactor



LPCVD Reactor



LPCVD Systems

