

CYCLONE EVAPORATOR

ABSTRACT OF THE DISCLOSURE

A cyclone evaporator includes an evaporator body with an evaporation chamber therein. The evaporation chamber preferably includes a thermally conductive sidewall having a generally cylindrical upper portion and a downwardly tapered lower portion. The evaporator body further includes a cover having a vapor outlet opening into the evaporation chamber and an outlet tube. The outlet tube circumscribes the vapor outlet and extends into a lower portion of the evaporation chamber. A liquid precursor passage and a carrier gas passage extend through the evaporator body and open into the evaporation chamber. In one embodiment, the carrier gas passage is positioned to direct carrier gas parallel to liquid precursor flow and intersect the liquid precursor at a liquid precursor passage outlet within the evaporation chamber. In another embodiment, the carrier gas passage is positioned to direct carrier gas across an outlet of liquid precursor passage. In both embodiments, the carrier gas facilitates atomization of the liquid precursor and flows cyclonically to distribute the atomized liquid precursor within the evaporation chamber. The liquid precursor deposits on the thermally conductive evaporation chamber wall and evaporates to form a gas precursor. The gas precursor flows with the carrier gas and exits the cyclone evaporator through the outlet tube and the vapor outlet. The cyclone evaporator is particularly advantageous for evaporating low vapor pressure liquids useful in semiconductor fabrication processes such as chemical vapor deposition.

Figure 3