Experiment 1-X

Objective: To observe and learn the process of Thermal Evaporation in the laboratory.

Theory: Thermal evaporation stands as a fundamental microfabrication technique, integral to depositing thin films for various applications in electronics and nanotechnology. In this process, a material in a crucible is heated to its vaporization point, forming a vapor that condenses onto a substrate, creating a uniform thin film. Widely employed in semiconductor manufacturing, thermal evaporation facilitates the production of metallic layers, dielectrics, and organic materials with precision. Its versatility extends to coating complex three dimensional structures, making it essential for microelectromechanical systems (MEMS) and integrated circuits. This cost-effective, scalable method remains pivotal in achieving precise material deposition for advanced microfabrication and device manufacturing.

Materials used: • Silicon wafer samples • Tweezer • Metal to deposit (Al) • Inert gas connection • Thermal Evaporation setup

Procedure:

• First we need to ensure that the vacuum chamber is clean and free of contaminants.

• Then we need to pump down the chamber to achieve the desired vacuum level, typically in the range of 10-6 to 10-7 Torr.

• Load the material to be evaporated (evaporation source material) into a crucible or boat made of a material compatible with the source material.

• Place the substrates on the substrate holder, ensuring they are properly aligned and at a suitable distance from the evaporation source.

• Apply power to the resistive heating source to heat the evaporation source material. The temperature is controlled to achieve the material's vaporization point.

• As the material evaporates, the vaporized particles travel in the vacuum and deposit onto the substrates, forming a thin film.

• Monitor the film thickness during deposition using a thickness monitor or by knowing the deposition rate and time.

• In this case the pressure is kept as 4.2 x10-6 Torr. and the deposition rate is kept as 0.6 A/s.

Observation:

Target material	Substrate	Deposition thickness	Deposition rate	Time	Working pressure

Other parameters involving the process: These parameters will be shown during the process.

Result: