

**A STUDY ON THE DESIGN OF A VACUUM AND HEATER
FOR FABRICATION OF AMORPHOUS SILICON
THIN FILM**

This thesis is presented in partial fulfillment for the award of

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ABSTRACT

A compatible vacuum system is vital for the successful operation of an evaporator for material fabrication process. This thesis describes the method of designing a vacuum system well suit for evaporation and deposition of amorphous silicon thin film. Several factors must be taken into consideration in the design of the vacuum so as to match the use. Analysis of the system was conducted before developing real vacuum system is crucial. Vacuum Simulation (VacSim Multi) is PC software for simulating vacuum system used in Vacuum Engineering and it was utilised for the purpose of pump selection. This software application can reduce the cost and time of developing the system using hands-on and test-and-build technique. From analysis, it was found out that a combination of Scroll and Turbo pumps or Rotary vane and Turbo pumps are suitable for use in fabricating the amorphous silicon at pressure not less than 10^{-5} torr. However, Rotary vane and Turbo pumps is the best since its pressure delivery is the most stable. The calculation of current supply for heater required at 0.295 A for the duration of 1 hour or 3600 s for evaporation of silicon to take place.

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CHAPTER 1

INTRODUCTION

Vacuum in Latin word means ‘empty’. According to American Vacuum Society (1958); the vacuum refers to the space filled with gas at pressure below atmospheric pressure. Except in outer space, vacuum occurs only in closed system. In the simplest terms, any reduction in atmospheric pressure in a closed system may be called a partial vacuum. It can be achieved by evacuating air from the system.

When the space is partially emptied, the volume of gas molecules is fewer than the surrounding atmosphere that is below atmospheric pressure [1],[2].

Vacuum technology plays important role and it is indispensable to many of modern technology. The applications including mechanical, electrical, chemical engineering and a lot more branches of industries and research.

Vacuum industries recognized the pressure ranges as follow:

Table 1.1 Pressure Range for Various Vacuum Processes [2], [5]

	Name of Pressure Range	Pressure in Torr	Applications
1	Coarse Vacuum	760 – 1 Torr	Food packaging and freeze dried products.
2	Rough Vacuum	$760 - 10^{-3}$ Torr	
3	High Vacuum	$10^{-4} - 10^{-8}$ Torr	Decorative coating, chemistry research and semiconductor manufacturing process.
4	Ultra High Vacuum	$10^{-9} - 10^{-12}$ Torr	Research studies, material and physics research and surface analysis.