

# Design Study of Vacuum Chamber for NF<sub>3</sub> Gas based Glow Plasma Discharge System

## Abstract

Abstract:

The plasma-based chemical process plays a vital role in the manufacturing of microelectronics devices, surface coating, and surface cleaning. It is also utilized in the removal of specific entities from contaminated surfaces which leads to the reduction of radioactive waste. The plasma etch process is widely used in various commercial applications such as semiconductor manufacturing, vertical nanostructure arrays (VNA), etc. The plasma etch process happens through the gas species interaction with surface species. The interaction results in the volatile species which is easily come out from the surface due to low vapour temperature. The rate of volatile species generation accelerates the surface etching process. The formation of species are depends on the plasma parameters such as electron temperature, electron and ion density. The plasma etching systems consist of vacuum vessel, RF power source, vacuum pump and exhaust system. The design of etch system is an important aspect in combine process.

The project work is for the design of vacuum chamber of the NF<sub>3</sub> plasma discharge system. Vacuum chamber dimensions are 300 mm ID and 500 mm length. It has 4 ports on its periphery. Base vacuum pressure of  $5 \times 10^{-5}$  mbar and working pressure is in the range of the  $5 \times 10^{-3}$  to 0.5 mbar range. Work involves the mechanical design of static vacuum chamber for external pressure as per ASME code. The work includes the calculation according to design by rule method, different iterations will be carried out to optimise the design thickness and related maximum allowable working pressure. The work requires the knowledge of ms excel, fundamental understanding of pressure vessel design and knowledge of mechanical engineering in terms of material, different type of stress on different entities.

This project includes the literature survey, ASME code, analytical calculation, iterations in calculation and report preparation.

## Academic Project Requirements:

1) **Required No. of student(s) for academic project: 1**

2) **Name of course with branch/discipline: B.E./B.Tech. Mechanical Engineering**

3) **Academic Project duration:**

(a) **Total academic project duration: 12 Weeks**

(b) **Student's presence at IPR for academic project work: 4 Full working Days per week**

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