Vacuum Science and the Inuence of Vacuum Conditions on Thin Film Growth

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Contents

Abstract

Write here, what we did and learned.

1 Theorie

1.1 Kinetic Gas Theory

1.2 Pumps

1.2.1 Pre Pump

1.2.2 Turbo Pump

1.3 Sputtering

1.4 Flow

1.4.1 Laminar

1.4.2 Turbulent

1.4.3 Resistance

1.5 Gauges

1.6 Questions

1.6.1 Day1

- What causes the limit on the pressure one can reach with the pre-pump alone?
- Calculate the mean free path of a nitrogen (N2) molecule in atmospheric pressure and at 1 109 mbar
- Based on the data from section 5.3, how much gas is desorped from the walls after the turbo reaches full speed? Hint: Consider the data over the time period after the turbo reaches speed. This is the pressure drop in a xed time. The volume of the chamber is 30 litres and you can assume the chamber is at a constant temperature of 293K. The mass of air is approximately 29g/mol.
- What is the purpose of baking out a chamber?
- What is the thermal energy at room temperature and the corresponding thermal speed of a water molecule (H2O)?

1.6.2 Day2

- Can you name some properties which might arise due to scaling down the thickness of a sample?
- How have the elemental peaks changed from the spectra of the rst day? What can you say about the baking process? How will the baking process aect the quality of the samples being grown?

- Why does the pressure oscillate with clear periods of increasing and decreasing pressures during baking?
- What happens to the plasma as you increase the power being applied to the cathode? Page 14 of 34
- Why do we pre-sputter the target before deposition?
- Plot the Polanyi-Wigner equation as a function of desorption energy for an ensemble of 5.35x1013 particles for Tw = 300K, 500K, 800K, 1000K for Edes between 0 and 60 kJ/mol-1 (universal gas constant 8.31 J/mol-1). Scale the y-axis to 1013 as a maximum.

2 Experiment

2.1 Description

2.2 Data Analysis

2.3 Evaluation