PROJECT 4
INVESTIGATING THE GROWTH TENDENCIES OF MONOLAYER AND BILAYER GRAPHENE

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Abstract

Graphene, a single layer of carbon atoms arranged in a hexagonal lattice, has garnered significant attention in recent years due to its exceptional electronic and mechanical properties. In this paper, a simulation consisting enable the study of graphene parameters and their affect on growth. The configuration of parameters temperature, pressure, and flow can lead to certain types of graphene growing certain places after being produced via chemical vapor deposition. We conclude that monolayer and bilayer graphene is more common near the edges of multilayer samples.

I. INTRODUCTION

In this paper, we study graphene growth. Graphene is a single layer of carbon atoms arranged in a two-dimensional hexagonal lattice. It has revolutionary electrical, mechanical, and optical properties. The ability to control the growth and characterize graphene is crucial for advancing its applications in various fields, including electronics, energy storage, and sensors. The type of graphene and where it is located on the sample is of high interest. The goal is to understand the most likely areas to find chemical vapor deposition grown samples that contain large amounts of monolayer and bilayer graphene. This paper determines these areas and hypothesizes why they exist where they do.

II. ALGORITHM ANALYSIS

The first program generates a random distribution of graphene points, simulating the chemical vapor deposition process we use to grow our graphene samples. The configurable parameters influence the resulting graphene distribution, allowing for the investigation of various growth scenarios if desired. The program characterizes the graphene points into three categories: monolayer, bilayer, and multilayer, based on their x-coordinate values. If the temperature is above 1000 Kelvin, then all the x coordinates are multiplied by 2. If pressure is greater than 1000 all of the coordinates get multiplied by 2. If the flow rate is greater than 0.3 the x and y coordinates are divided by 2. This is done to mimic the unpredictability of down versus upstream in thin films such as graphene in our system. All of the data produced is put into a text file for the next program to analyze.

The second program reads the data from a text file generated by the first program and plots the graphene points on a scatter plot. This program allows for the examination of the effects of different growth conditions on the resulting graphene structures and their substrates. The scatter plot shows where types of graphene show up on the substrate. Changing the parameters and growth conditions changes the outcome, but not the conclusion.

III. OUTPUT INTERPRETATION

The question being answered is where it is most likely that we will find monolayer and bilayer graphene on a sample produced in our lab. These programs are a customized way for our group to study graphene growth and characterization through chemical vapor deposition. This allows exploration of different growth scenarios, enabling researchers to investigate the impact of varying parameters on the resulting graphene distribution and layer classifications.

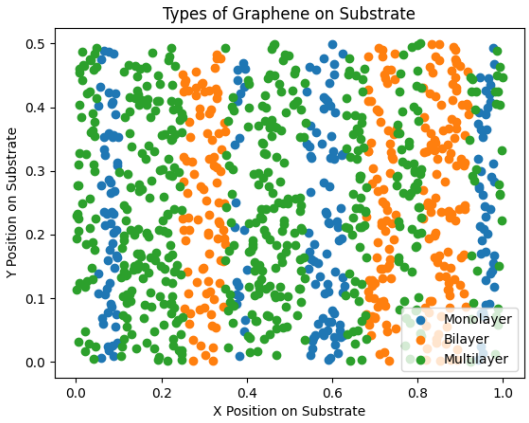

Figure 1: This sample exemplifies our most significant finding, that monolayer and bilayer graphene is most often found on the outskirts of multilayer graphene.

Using 500 data points per coordinate seems to be good enough to paint an accurate picture of the distribution and location of the different types of graphene.

IV.CONCLUSION

We conclude that monolayer and bilayer graphene is more common near the edges of multilayer samples. We will continue to run experiments that improve on this finding. Future work may involve expanding to incorporate additional

growth mechanisms and factors. This could enhance the exploration of graphene growth and characterization processes, helping to improve the field.

V. REFERENCES

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