

## Abstract

This project involved an in-depth understanding of current nanomaterial-based gas sensors, where spin coating technique is used to deposited graphene on glass substrates.

The project investigated the current literature that discusses graphene-based gas sensors. As no access to the lab was able, the results of the study were based on the findings in the literature review.

## Introduction

We are surrounded by sensors continuously. Sensors are fabricated from different materials, come in different shapes and sizes to perform different functions. Modern system are rarely constructed without sensors. Whether it is for an automated vehicle collision detection system, a vehicle's airbag or even an automated door

A sensor is a fundamental component for such systems to operate. This is one of the many reasons why sensors are a widely investigated topic on a global scale.

Current research is looking into methods of replacing silicon-based sensors with alternative materials. One of such interesting materials is graphene. This project investigates the use of graphene to fabricate gas sensors, which can fill a wide range of various gas related applications

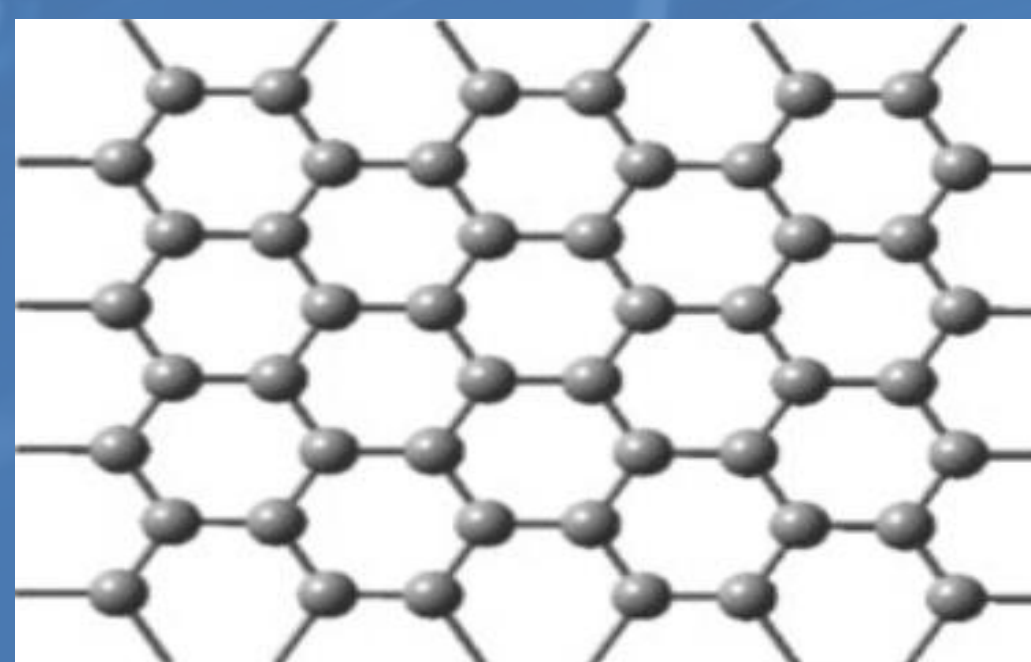


Fig.1 Graphene

## Objectives

The project's objective is to understand the fabrication process of graphene-based gas sensors and to use such sensors to fill potential gaps in various gas sensing related applications.

As a prerequisite to the fabrication of gas sensors, an initial objective is to understand graphene as a material and study the current use of graphene in academic research and in commercial applications.

The aims of the project are to comprehend the different properties of graphene and the wide variety of graphene-based applications. Moreover, to become familiar with the laboratory process required to fabricate a gas sensor based on graphene, if an opportunity comes where laboratory work is possible

## Graphene

Graphene is a synthetic two dimensional form of carbon, It was first discovered by A.Geim and K.Novoselov in 2004, via exfoliation of graphite [1]. Graphene is a carbon-based molecule with the potential of replacing current silicon-based electronics. This potential is based on the extraordinary properties of graphene which caught the interest of scientists. Since then, it has attracted immerse attention due to its outstanding electrical and mechanical properties. This project used graphene as a conductive sensing material, in order to utilise graphene's outstanding electrical properties.

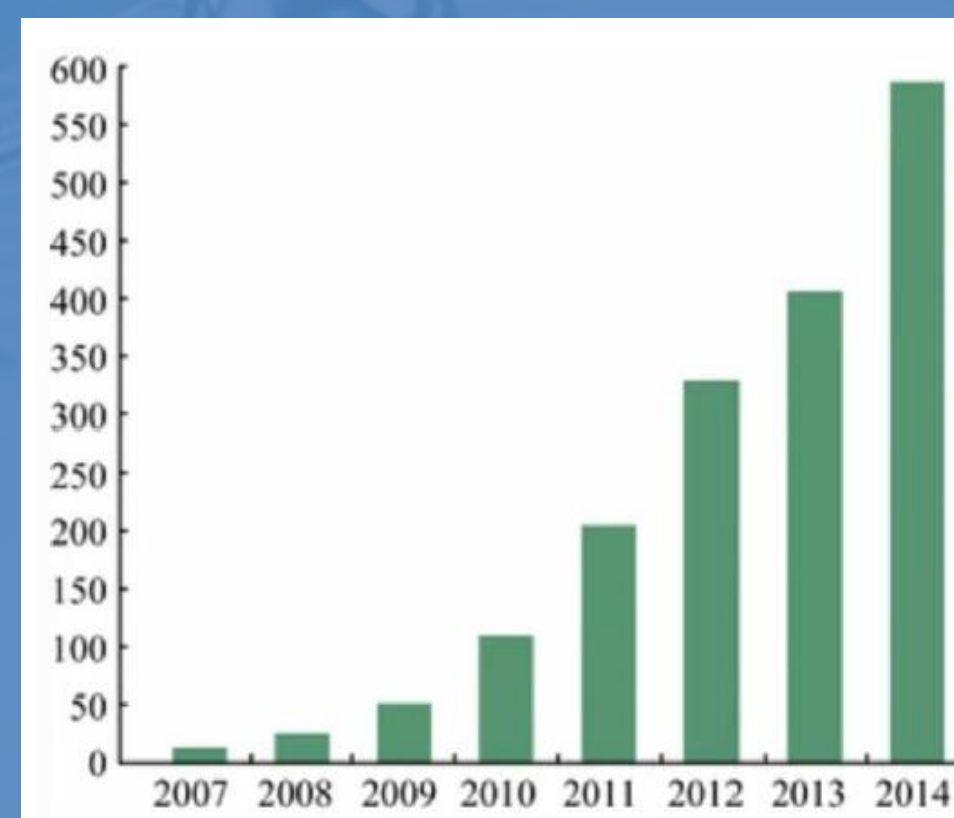


Fig.2 Graphene [2]

## Methodology

The project methodology initially insisted of a systematic research, which involves an in-depth literature review, allowing the extraction of useful methods that can be used to further enhance the graphene sensor. The deposition method of choice would have been spin coating. The project would investigate the difference between centered spin coating techniques and off-centre spin coating techniques.

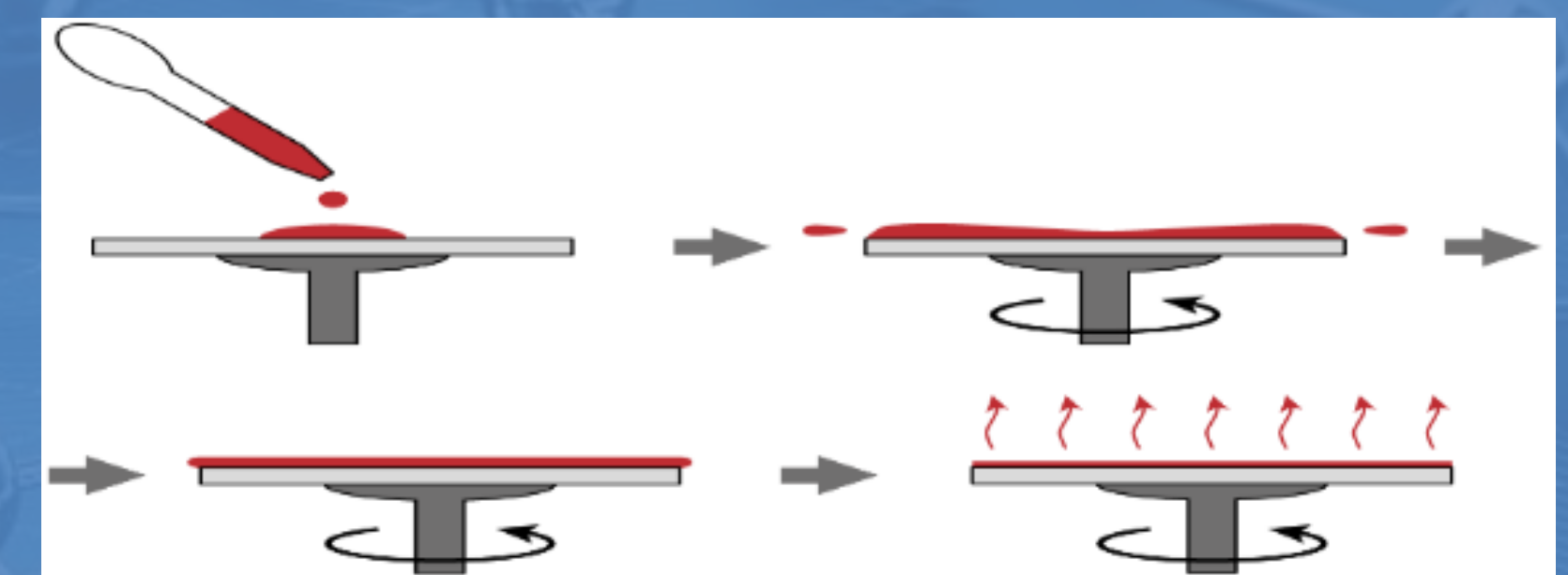


Fig.3 Spin coating deposition

## Sensor comparison

The deposited gas sensors would then be compared in terms of electrical characteristics and surface properties. This is achieved through the use of LCR meter, which allows investigation of inductance, capacitance and resistance

Surface properties are investigated using the Atomic Force Microscopy (AFM). This allows the study of the sample's thickness and deposition uniformity, which is useful method for the comparison of differently fabricated gas sensors.

## References

- [1] K.S. Novoselov, A.K. Geim, S.V. Morozov, D. Jiang, Y. Zhang, S.V. Dubonos, I.V. Grigorieva, A.A. Firsov, Electric field effect in atomically thin carbon films, *Science* 306 (2004) 666–669
- [2] Wang, T., Huang, D., Yang, Z., Xu, S., He, G., Li, X., Hu, N., Yin, G., He, D., & Zhang, L. (2015). A Review on Graphene-Based Gas/Vapor Sensors with Unique Properties and Potential Applications. *Nano-Micro Letters*, 8(2), 95–119. <https://doi.org/10.1007/s40820-015-0073-1>