Creation of a 2D Field Effect Transistor using Chemical Vapor Deposition

(To be utilized in Characterizing the Gaseous Composition of the Martian Atmosphere)

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This material is based upon work supported in part by the National Aeronautics and Space Administration under Grant No. 80NSSC20M00043."

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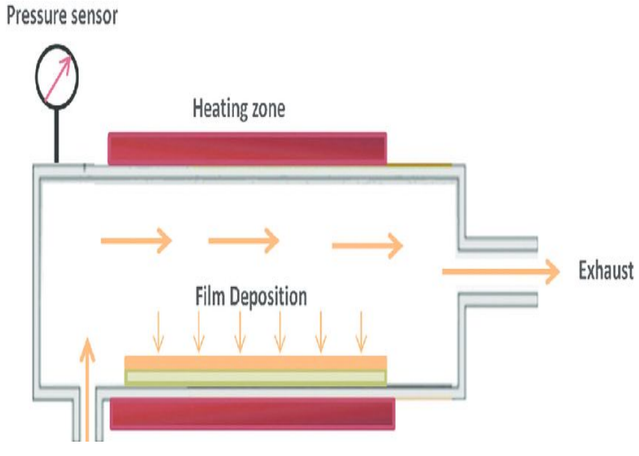
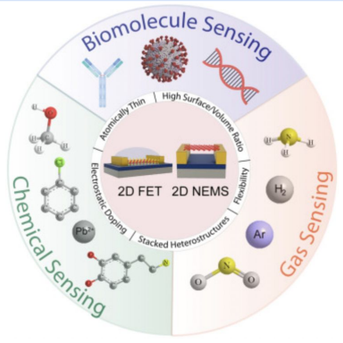
Overview:

This project utilizes a process called Chemical Vapor Deposition in an attempt to deposit multiple 2D materials onto Copper or sapphire substrates placed on Silicon wafers to create an FET (Field Effect Transistor). The FET will be used as a sensor in an attempt to efficiently characterize the martian atmosphere.

Chemical Vapor Deposition (CVD):

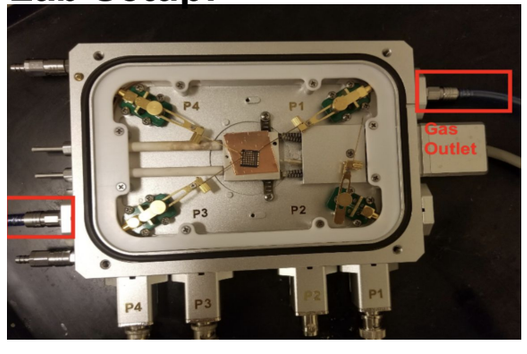




Introduction:

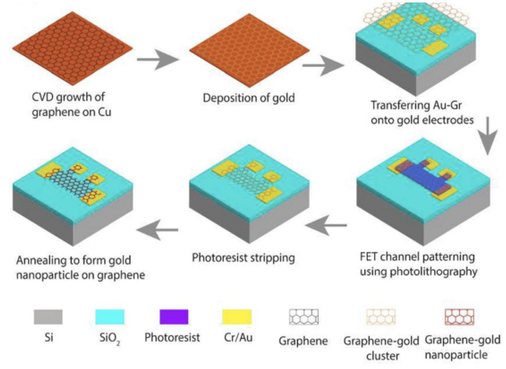
The purpose of the study is to further investigate the selective sensing capabilities of 2D materials. They already show much promise because of their high efficiency of detection and sensitivity.. Further research and implementation of 2D sensor technology would aid many fields, from space exploration, hazard detection, or commercial use.

Lab Setup:



Methods and Device Fabrication:

The method of obtaining the best 2D sensor material is to first grow each of the 2D materials utilizing CVD, deposit the 2D material onto Si or Sapphire wafers, connect electrodes and use photolithography to create the FET. After the transistor is created, tests can be run to see the sensitivity of the material.

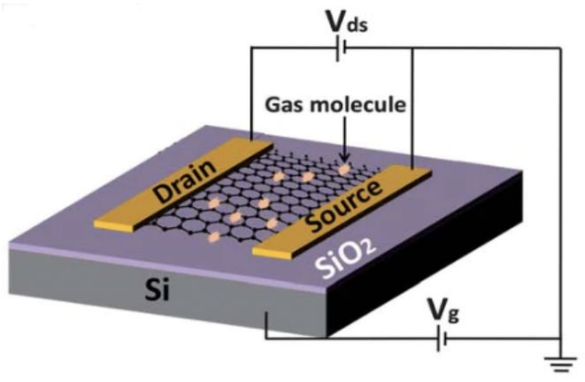


Anticipated Results:

Molybdenum Disulfide (MoS2) is anticipated to be the best 2D material because of its semiconductive nature/ electronic properties in comparison to the other 2D materials.

Mechanism:

- Graphene FET's material is semiconducting
- As gas molecules come into contact with graphene, adsorption and desorption occur and change the electrical properties of graphene



Conclusion:

The findings will benefit scholars in the field because understanding which 2D materials have the selectivity needed for the specific measurand will allow for the fabrication of more efficient, sensitive, and better performing sensors.