Hydrogenating the Surface of Diamond

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Introductions

● Millersville Senior

● Physics & Math

● Mentor - Dr. Andrei Kolmakov

● NIST - Physical Measurement Laboratory - Advanced Electronics
Why Diamond?

- Thermal Conductivity
- Radiation Damage Resistance
- High Power Inputs
- High Carrier Mobility
- High Breakdown Voltage
- Robust Material

(Casa D’Oro, 2022)  
(electronic circuitry, 2023)
Doping Diamond

- **Increasing** Electrical Conductance
- Impurity Doping challenging
- **Transfer Doping**
- Band Bending

(Crawford, 2017)
Method

Gas Cylinder

Pressure Sensor

Furnace

Exhaust

Turbo Pump

Temp. Control

Flow Controller

Diamond Sample
In The Lab

Two Probe Setup
Four Probe Setup
Hydrogenation Setup

Sample Placement
Discussion

- Ohmic vs Non-Ohmic (right)
- Four Probe Formula (above)
- 700-1000 kΩ
- Ideally 10x improvement
- Progress!

Challenges

- Polishing (roughness)
- Gas (Oxidative) Impurities
- Time allotment
Future Plans

● Lithography
● Electrical Devices
● Hall Measurements

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Citations