

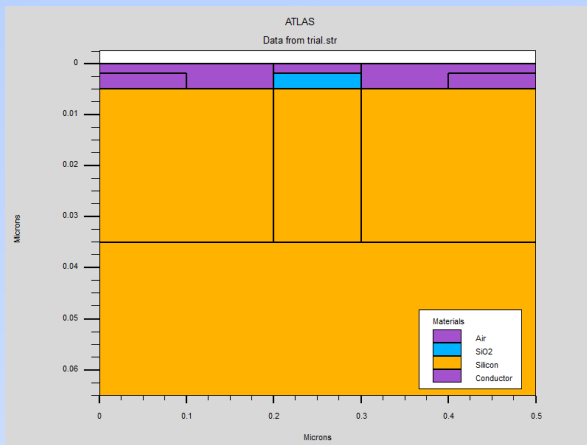
Simulation and Comparison of MOSFETs with Different Channel Materials

Using Silvaco TCAD Si, Ge & SiGe
MOSFETs

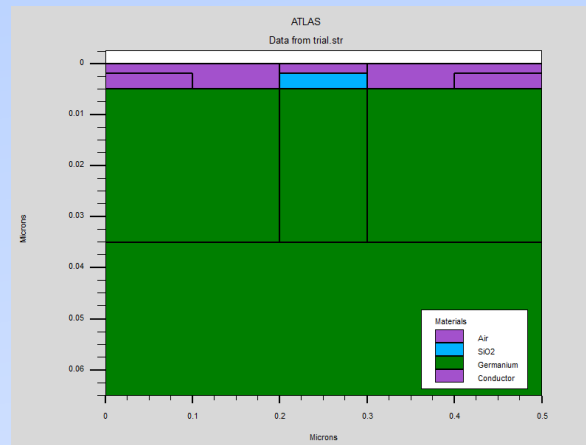
Project Objective and Tools Used

- Objective:
- To simulate and compare the I-V characteristics of MOSFETs with different channel materials:
 - - Silicon (Si)
 - - Germanium (Ge)
 - - Silicon-Germanium (SiGe)
- Tools Used:
 - - Silvaco ATLAS (TCAD)
 - - TonyPlot (Visualization)

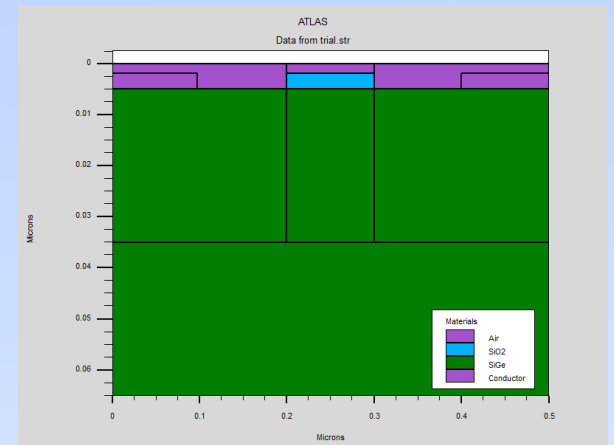
MOSFET Structures in Silvaco TCAD



Silicon Structure

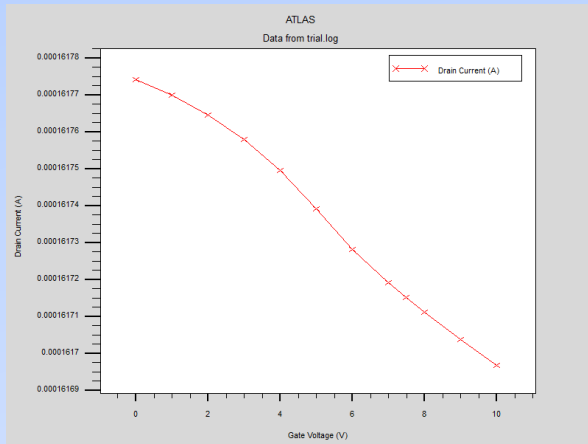


Germanium Structure

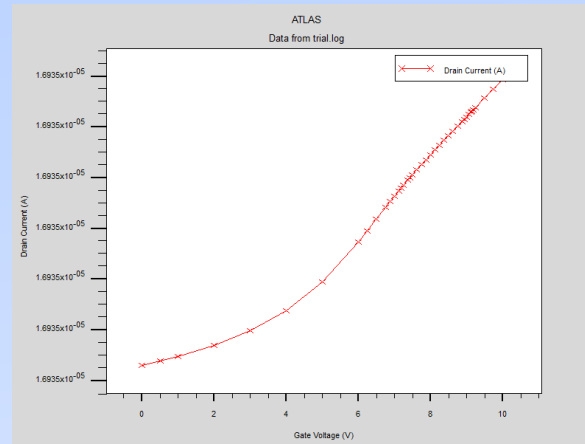


Si-Ge Structure

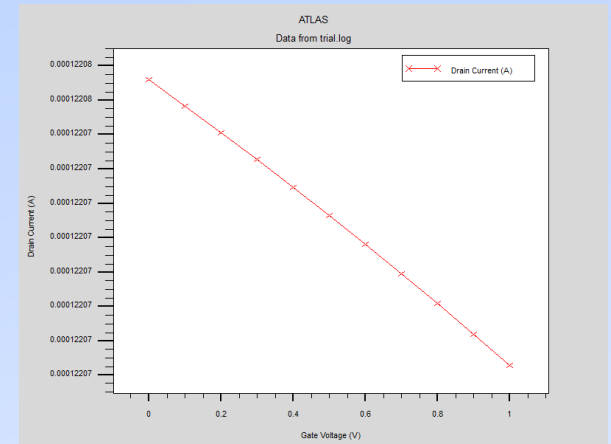
I-V Characteristics of Simulated MOSFETs



IV Characteristic for Silicon



IV Characteristic for Germanium



IV Characteristic for Si-Ge

Comparison and Key Observations

- Drain Current Performance:
 - - Ge MOSFET shows highest current due to better carrier mobility.
 - - SiGe MOSFET balances performance and leakage.
 - - Si MOSFET has the lowest current but stable performance.
- Applications Insight:
 - - SiGe may be more suitable for low-power, high-performance designs.
 - - Ge offers high-speed benefits but with thermal/leakage trade-offs.

Conclusion

- Successfully simulated and analyzed MOSFETs with Si, Ge, and SiGe channels using Silvaco TCAD.
- Simulation results show how material choice significantly impacts electrical characteristics of devices.
- This study reinforces the importance of TCAD in evaluating semiconductor design options before fabrication.