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Optical Characterization of Thermal Transport Across Graphene/h-BN Hetero-junction

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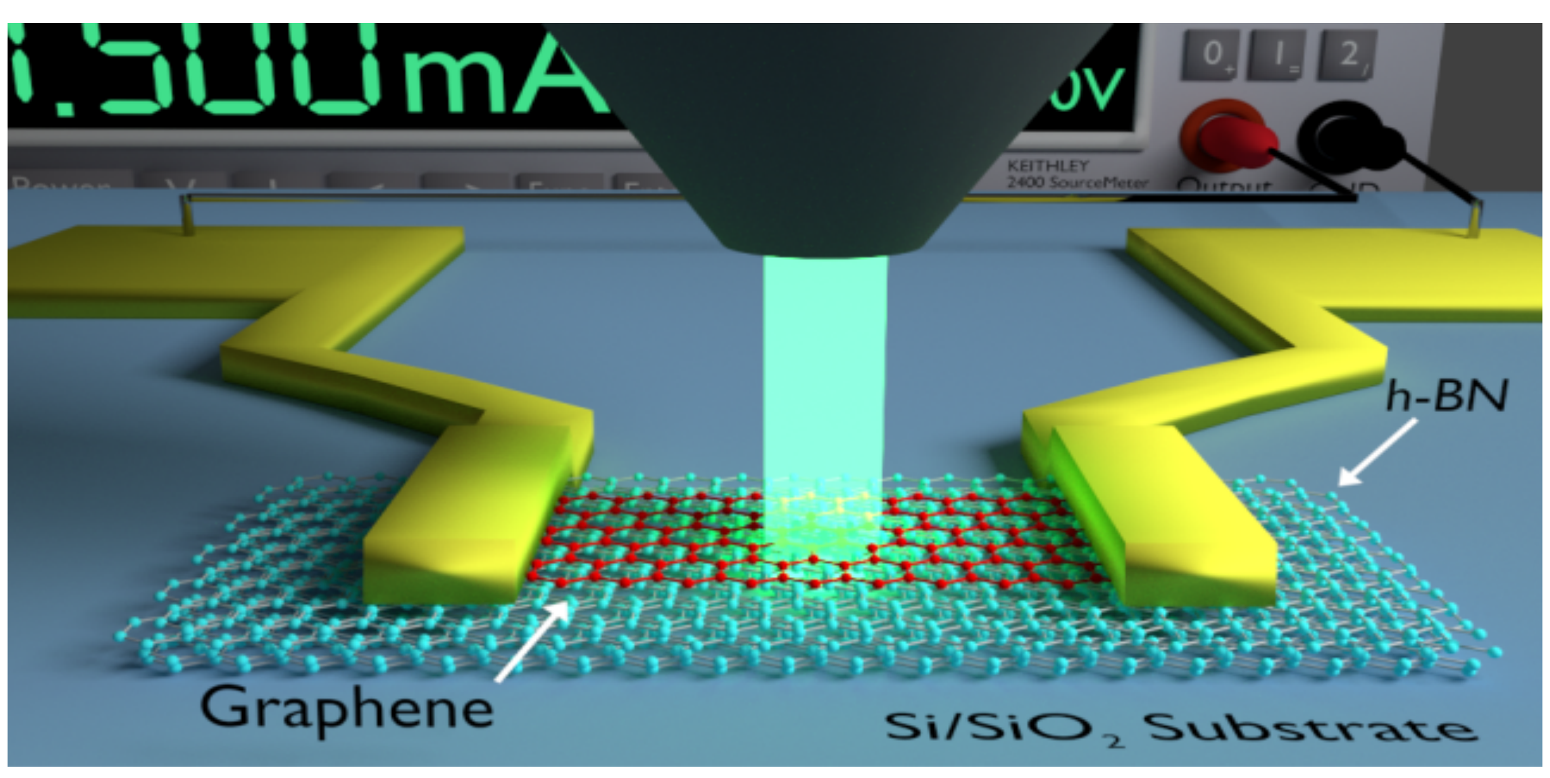
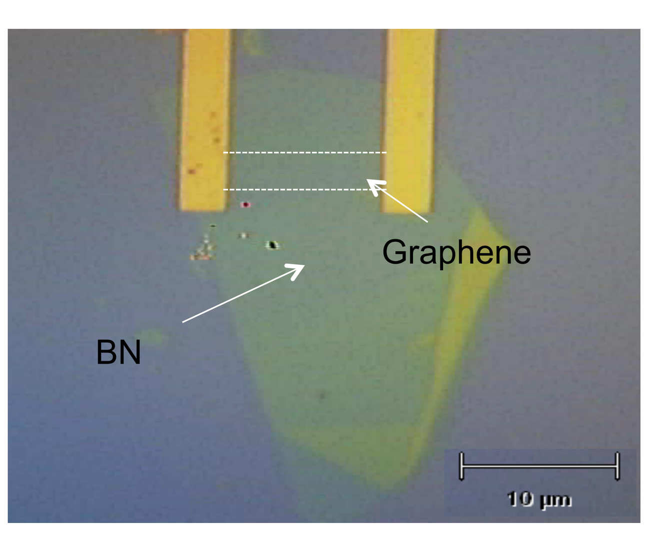
Motivation & Introduction

- Emergence of novel 2d hetero-structure devices
- Interesting transport phenomenon, rectification and negative differential resistance in graphene based devices
- The operating temperature and device performance affected by interfacial thermal conductance
- Experimental Measurements of interfacial heat transport across the junctions lacking

Experimental Setup

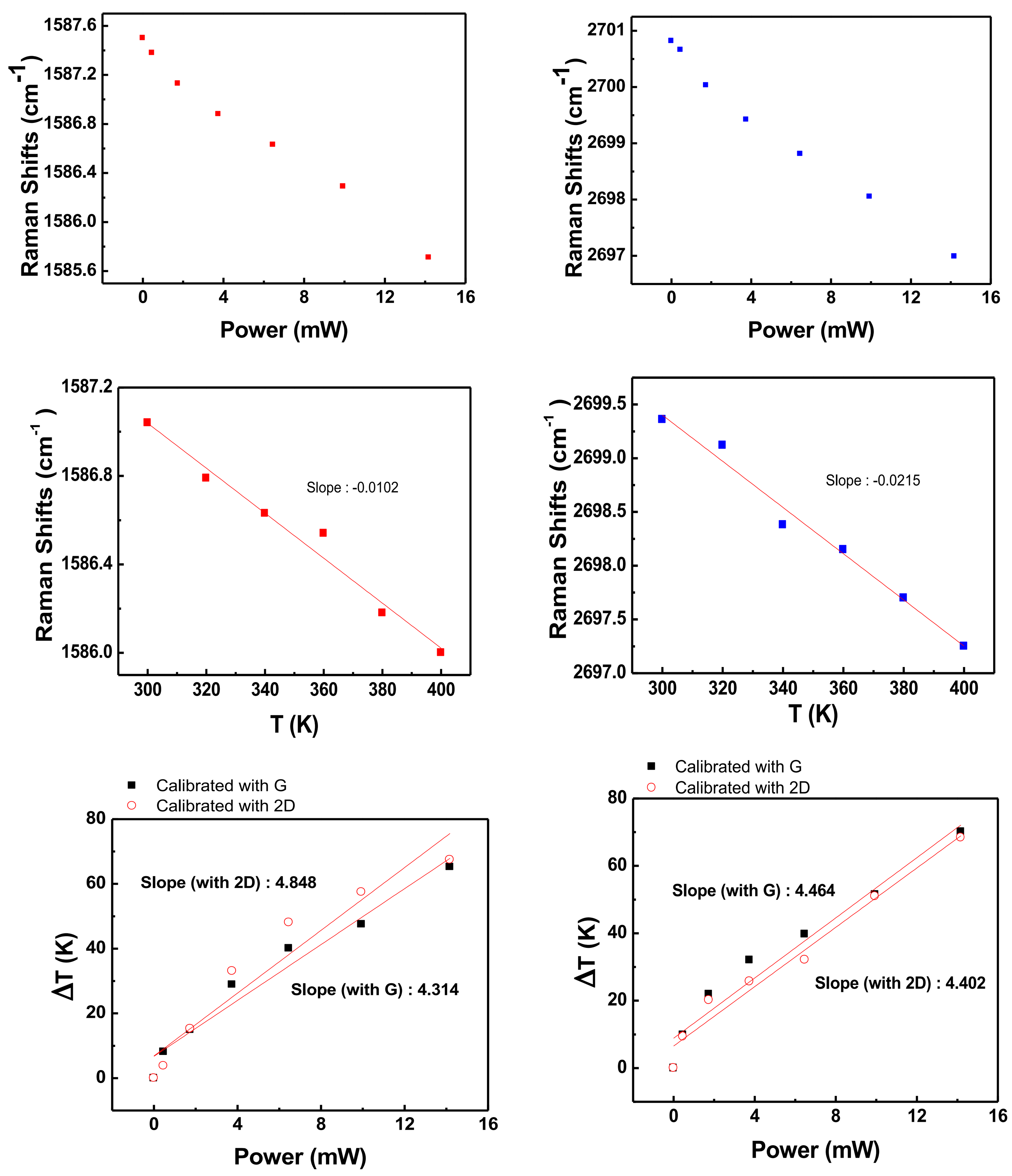




Experimental Method

- The fabricated device is placed on a cryostat
- Joule heating of underlying graphene layer using applied current ($P=I^2R$)
- Raman spectra of Graphene (G band (1580 cm^{-1}), 2D band (2680 cm^{-1}) and h-BN (1370 cm^{-1}) downshifts with temperature
- Calibrate downshift as a function of Temperature
- Measure downshift of Raman spectra for every 0.25 mA increment of current
- Use the calibration graph to obtain the change in temperature as a function of Power applied

Results



$$G_{th} = \frac{Q}{A\Delta T}$$

Conclusion and Future Work

- G_{th} is reported to be 7.41 ∓ 0.43 $MWm^{-2}K^{-1}$
- Interface quality needs to be improved for higher Conductance
- Currently working on measurement of thermal transport across hetero-junction between graphene and various other 2d materials

References

Chen, Chun-Chung, Zhen Li, Li Shi, and Stephen B. Cronin, "Thermal Interface Conductance across a Graphene/hexagonal Boron Nitride Hetero-junction." Appl. Phys. Lett. 104, 081908 (2014)

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