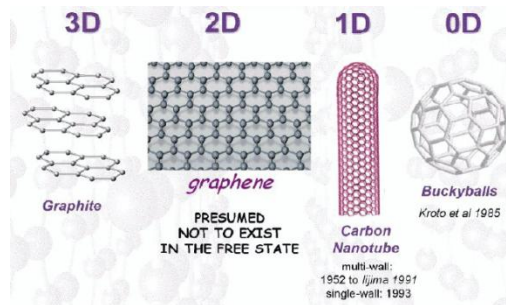# Graphene-based Thermal Interface Materials

## Faculty: X. L. Ruan, Y. P. Chen, T. Fisher    Student: J. Hu, B. Qiu
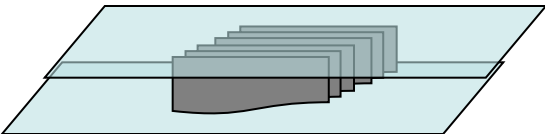
## Objective

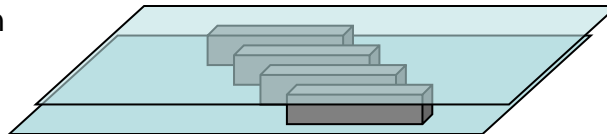Develop graphene based thermal interface materials (TIMs) that can enhance the TIM performances.
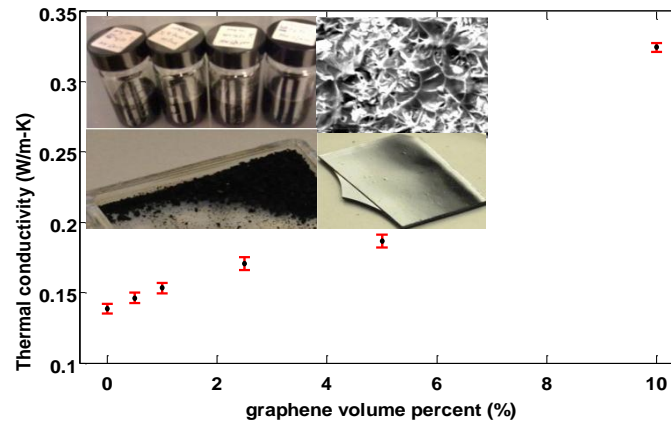


## Approach

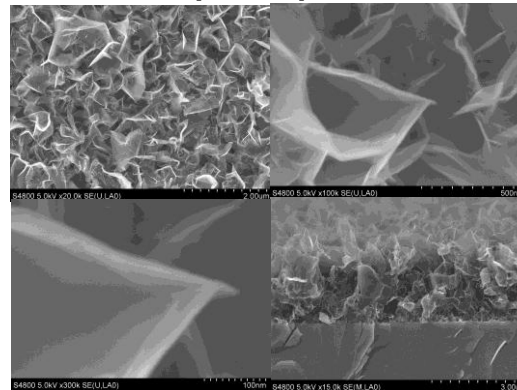- Approach 1: Vertically grown (CVD) graphene sheets between (and bonded to) substrates



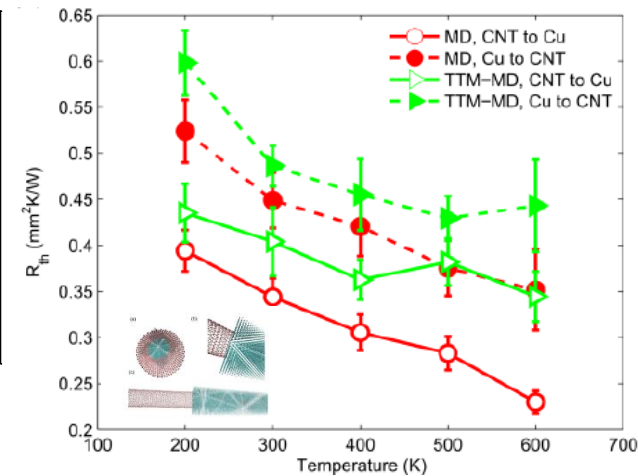- Approach 2: Graphene composite/Graphite micro platelets/powder between substrates



### Graphene composite thermal conductivity



### Graphene petals



### Cu-CNT interface simulation



## Impact

- Thermal conductivity can be dramatically enhanced by adding graphene fillers.
- Thermal interface between $SiO_2$ and graphene petals grown on silicon and copper by MPCVD is characterized by $3\omega$ method and the thermal interface resistance is estimated to be as low as $1.2 - 3.2$ mm$^2$K/W.

## Publications

- J.N. Hu, W. Park, X.L. Ruan and Y. P. Chen, Proceedings of MRS Spring Meeting (2012).
- Y. Wang, S.Y. Chen, and X.L. Ruan, Appl. Phys. Lett., **100**, 163101 (2012).
- J.N. Hu, Y. Wang, A. Vallabhaneni, X.L. Ruan, and Y.P. Chen, Appl. Phys. Lett., **99**, 113101 (2012).

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