Fabrication of 2D Material Based NEMS Resonators

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Abstract

2D materials such as graphene [1], MoS\textsubscript{2} [2] and phosphorene [3] are promising candidates for resonating mechanical sensors due to excellent tunable electrical/mechanical properties, low masses, and maximal surface to volume ratios.

Mechanical resonators based on suspended graphene have been realized.
- CVD graphene wet-transferred onto 10x10 mm Si/SiO\textsubscript{2} chips with Au electrodes
- Graphene patterned in O\textsubscript{2} plasma with a resist mask
- Graphene is released by etching SiO\textsubscript{2} in BHF and critical point drying

Graphene Transfer

1. CVD graphene on Cu
2. Spincoat PMMA
3. Etch backside graphene
4. Etch Cu
5. Fish graphene/PMMA on substrate
6. Bake the film overnight
7. Remove PMMA
8. Graphene on substrate

Device Fabrication and Results

1. Chip with electrodes
2. Graphene transferred
3. Graphene patterned
4. Graphene released

Fig. 1: SEM pictures of fabricated devices having different dimensions. Scale bar: 1 µm.

Measurements

- Sheet Resistance Measurement with Transmission Line Method
- Field Effect Transistor Behavior

Conclusions

- Suspended graphene sheets 3-9 µm in width and 2-8 µm in length have been fabricated.
- Graphene’s sheet resistance was measured to be 1500 Ohms/Sq and 500 Ohms/Sq for unsuspended and suspended graphene, respectively.
- Graphene’s FET behavior was confirmed.
- The next step is to implement electrostatic transduction and operate the device at its mechanical resonant frequency.

References


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