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Novel Fabrication Techniques for Wafer-Scale Graphene Drum NanoElectroMechanical Resonators SUNWOO LEE, CHANGYAO CHEN, VIKRAM V. DESHPANDE, GWAN HYOUNG LEE, Columbia University, ISAAC STORCH, Cornell University, CONGCHUN ZHANG, YOUNG-JUN YU, PHILIP KIM, Columbia University, PAUL MCEUEN, Cornell University, JAMES HONE, Columbia University — Graphene NanoElectroMechanical Systems (NEMS) have shown excellent mass sensitivity as well as resonant and oscillatory behaviors that are desirable in mass sensors and active elements in Radio Frequency Integrated Circuit (RFIC) design. Out of many structures proposed for graphene NEMS, it has been recently shown that a drum resonator exhibits higher Q-factor than other structures such as a bar resonator. However, fabricating a large array of drum graphene resonator has been problematic because liquid or gas can be trapped inside the drum. Such issues led to designs with a hole in the center of a drum or with a drainage trench, either at the cost of additional lithography step or lowered Q-factor. Here, we demonstrate two novel fabrication methods that are free of the trapping without any compromise in additional lithography step or Q-factor degradation. In one method, wafer scale graphene is dry-stamped on prefabricated leads, holes and local gates. In the other method, an resist strip with a circular hole at the center holds graphene underneath. I will discuss direct electrical readout and characterization of devices using these two methods. These drum structures may provide a practical way to achieve wafer scale high Q graphene NEMS.

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