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Site-directed Fabrication of High-quality Transfer-free Free-standing 2D Membranes PRADEEP WADUGE, JOSEPH LARKIN, ISMAIL BILGIN, Northeastern University, ADAM GRAHAM, Harvard University, KENNETH GOODFELLOW, CHITRALEEMA CHAKRABORTY, NICK VAMIVAKAS, Rochester University, MONEESH UPMANYU, SWASTIK KAR, MENI WANUNU, Northeastern University — We present an approach for direct growth of freestanding graphene and molybdenum disulfide (MoS2) membranes across prefabricated solid-state apertures. The freestanding 2D membranes are directly grown over microscale apertures in SiN membranes using chemical vapor deposition apparatus under appropriate temperatures and pressures. The 2D membranes grow preferentially over apertures, resulting in sealed membranes that are one to a few layers thick. The mechanisms by which these growths occur are investigated, which favor aperture-limited growth. The membranes are shown to be of great quality by atomic-resolution transmission electron microscopy, Raman spectroscopy, and photo luminescence spectroscopy. In addition, we demonstrate low-noise ion-current recordings through nanopores fabricated in such membranes. Finally, we highlight the functionality of these devices by measuring DNA translocations through nanopores in such membranes.

Pradeep Waduge
Northeastern University

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