



Atomic Membranes for 3D Systems

IRG-3

Atomic membranes are a new class of two-dimensional, free-standing materials only one atom thick yet mechanically robust, chemically stable, and virtually impermeable. The prototype atomic membrane is graphene, a honeycomb lattice entirely made of carbon atoms, but other emerging systems such as the III-V boron nitride (BN) materials offer exciting new properties. The central aim of this IRG is to extend miniaturization to its ultimate limit by creating atomically thin 2D “paper” materials that self-fold into incredibly responsive 3D structures with lateral features spanning the mm to nm scales.

To accomplish this goal, we will:

- (i) synthesize and characterize novel 2D atomic membranes (2D-AMs), analogous to the different kinds of colored paper in origami,
- (ii) develop approaches to bend and fold these 2D-AMs in response to environmental or external signals, and
- (iii) elucidate general design approaches to create 3D structures that could ultimately be used for devices with novel physical, optical, electrical, and/or chemical functionalities.

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