Nanomechanics of 2D material membranes

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In the drive of technological advancement, we are in constant need of materials for better sensors, smaller electronic and mechanical devices. Two-dimensional (2D) crystals are promising to address these challenges due to their atomic thickness [1][2]. Here, we explore which properties make 2D membranes, like that of graphene, so interesting, application-wise promising, and compelling to explore.

We explain the fabrication of 2D material membranes and nanomechanical techniques used to probe these. We discuss their notable mechanical properties, and show how these are utilized as pressure and gas membrane sensors [3][4].

We also look at membranes with more complex effects in their nanomechanical motion. In particular, we investigate the influence of second-order phase transitions on the mechanical properties of 2D material membranes [5]. Finally, we theoretically substantiate this connection and experimentally verify it for materials of different condensed matter physics phenomena such as 2D layered antiferromagnets, ferromagnets, and their heterostructures.

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