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标题: Application of graphene membrane in micro-Golay cell array
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摘要: We report the design, simulation, and fabrication of a miniaturized Golay cell array, implemented with monolayer graphene suspended over a TEM grid as the deflecting membrane. Currently, ultra-thin membranes for Golay cell applications suffer diminishing responsivity as the lateral dimensions are reduced to the microscopic scale. We propose graphene as the ideal membrane material for micro-Golay cell arrays, whereby the minimal elastic stiffness of atomically thin graphene allows membranes to be scaled to microscopic dimensions. We examine how graphene's unique material parameters, such as high mobility, negligible gas permeability, and supreme strength, offer ease of fabrication and improved performance over existing technology. Simulations of graphene membrane deflection versus temperature are presented, with an analysis of the optimal geometry for maximum sensitivity. Cavities with all spatial dimensions under 100 mu m are predicted to provide sensitivities of hundreds of nanometres per Kelvin, in good competition with existing research on devices many times larger. Up to a four-fold increase in responsivity of 400 nm/K is predicted for a graphene cell of the same dimensions as current technology, and a three-fold increase for a cell one quarter the diameter. These predictions permit an increased detector density in a focal plane array application while still providing improved responsivity. Furthermore, our fabrication method permits the construction of arrays consisting of thousands of devices, avoiding individual cell assembly and including built-in electrical contacts due to the conductive nature of graphene. We also present a theoretical analysis of interferometric optical read-out of membrane deflection.
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