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The Design of optimized porous graphene membrane using COMSOL Multiphysics

We designed the porous graphene sheet to make nanoelectromechanical System(NEMS) resonator with high frequency and high quality factor. Using COMSOL Multiphysics, we found the geometric optimization of porous graphene membrane structure by tuning pore size, the position of pores and the number of pores. Comparing eigen frequency of first mode and quality factor of each geometry, it was found that as the number of pores increases, the bonding between carbons is broken and the damping decreases. So, we numerically calculated damping coefficient from Effective Young Modulus obtained by COMSOL Multiphysics. Then, we simulated and obtained the optimal structure, which maintains the eigen frequency highly also the quality factor is high. Through this simulation, we also confirmed the geometric changes in NEMS are very large when compare to MEMS.