Quantitative Nanomechanical Mapping of Suspended Graphene

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Abstract

I present quantitative nanomechanical maps [1] of suspended graphene membranes, both monolayer and multilayer. Peakforce QNM, a new off resonance tapping AFM mode, allows rapid mapping of force response curves at every pixel, two orders of magnitude faster than conventional force volume mapping. A range of nanomechanical properties, including the adhesion, modulus, dissipation and deformation can then be extracted in real time along with the topographic data. The stability and mechanical uniformity of large area membranes (>10 μm) as well as monolayer vs bilayer membranes are investigated and compared to results on smaller monolayer membranes [2]. Circular holes were created in silicon nitride membranes on silicon supports via a SF6 etch using a photolithographically defined etch mask. Mechanically exfoliated graphene flakes were then transferred onto the nitride membrane, leaving an array of suspended circular areas suitable for transmission characterisation methods such as TEM as well as AFM. The adhesion of the flakes to the silicon nitride membrane was also investigated, and compared with previously published results on silicon dioxide substrates [3].

References

[1] http://is.gd/ApzzOc
[2] C. Lee, X. Wei, J.W. Kysar, J. Hone, Science, **321** (2008) 385
[3] S.P. Koenig, N.G. Boddeti, M.L. Dunn, J.S. Bunch, Nat. Nanotech. **6** (2011) 543

Figures