Limits of stability in supported graphene nanoribbons subject to bending

Pekka Koskinen, Topi Korhonen

NanoScience Center, Department of Physics, University of Jyvaskyla, 40014 Jyväskylä, FINLAND
pekka.koskinen@iki.fi

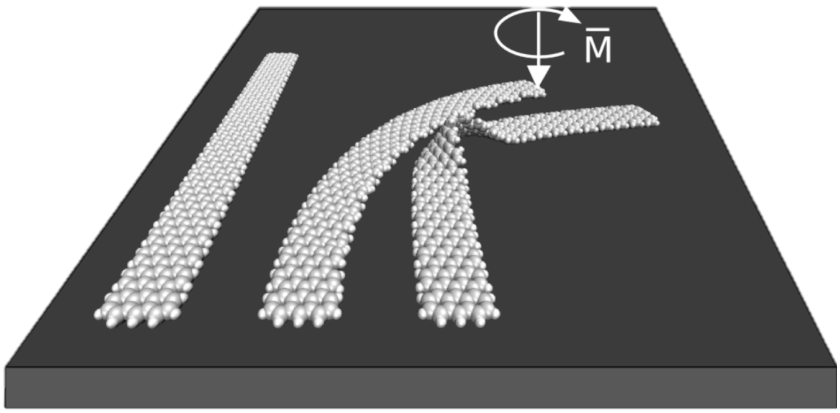
Abstract

Graphene nanoribbons are quasi-one-dimensional nanostructures that are readily deformed.[1,2] They are particularly prone to bending, which is known to affect their electronic properties.[2,3] Yet, what is still unknown is the amount of bending that ribbons can stably withstand when physisorbed on various substrates. Here we present a study of the stability limits of 0.5-1.5 nm wide armchair graphene nanoribbons subject to bending by using molecular dynamics simulations. We observe that the limit for maximum stable curvatures are below ~10 deg/nm in case the bending is externally forced and the stability is limited by buckling instability. Furthermore, the limit for maximum stable curvatures are below ~2 deg/nm in case the bending is not forced and the stability limit arises only because of the corrugated potential energy landscape due to the substrate. Both of the stability limits lower when ribbons widen. These results agree with recent experiments and can be understood by means of transparent elasticity models.[1,4,5]

References

[1.] J. van der Lit, P. H. Jacobse, D. Vanmaekelbergh, I. Swart *New J. Phys.* **17**, 053013 (2015)
[2.] P. Koskinen *Phys. Rev. B* **85**, 205429 (2012)
[3.] C. Gomes da Rocha, R. Tuovinen, R. Van Leeuwen, P. Koskinen *Nanoscale* **7**, 8627 (2015)
[4.] P. Koskinen J. Phys.: Condens. Matter **25**, 395303 (2013)
[5.] T. Korhonen, P. Koskinen, *submitted* (2016)

Figures



Buckling of sufficiently bent graphene nanoribbon on an adhesive model substrate.[5]