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Molecular Dynamics Study of Ripples in Graphene and Bilayer Graphene ARUNIMA SINGH, RICHARD G. HENNIG, Department of Materials Science and Engineering, Cornell University — Transmission electron microscopy experiments have shown that suspended graphene is not perfectly flat, but displays ripples such that the surface normal of graphene varies by several degrees [1,2]. For multi-layered graphene, the ripples are suppressed with increasing numbers of layers. Recent experiments demonstrated that ripples in suspended graphene can also be controlled by mechanical and thermally induced strain [3]. Knowledge of and control over the ripples in graphene is desirable for fabricating and designing of strain-based devices. We show using molecular dynamics simulation that thermally induced ripples in suspended single and multi-layer graphene at room temperature result in deviations of the local surface normal by $\pm$ 7 $^\circ$ and $\pm$ 4 $^\circ$ for single and bilayer graphene, respectively. These angular deviations are in excellent agreement with transmission electron microscopy results [2] and confirm that these ripples can be dynamic and thermally induced. We also study how these angles change as a function of applied tensile and shear strain. [1] Meyer J. C., Geim A. K., et al. Solid State Communications, 143, 101 (2007). [2] Meyer J.C., Geim A.K., et al. Nature, 446, 60 (2007). [3] Bao W., Miao F., et al. Nature Nanotechnology, 4 (9), 562 (2009).

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