Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Role of defects and geometry in the strength of polycrystalline graphene ZHIGONG SONG, ZHIPING XU, Tsinghua Univ — Defects in solids commonly limit mechanical performance of materials by reducing their rigidity and strength. In two-dimensional crystals, however, we report in this work that topological defects induce a prominent geometrical effect in addition to local stress buildup. These dual roles of defects modulate both local and global mechanical properties of the material in an unexpected way. We demonstrate through atomistic simulations and theoretical analysis that in some cases local response of two-dimensional crystals can even be stiffened and strengthened by topological defects. These new findings not only shed lights on mechanical characterization of two-dimensional materials, but also add a new dimension to material design, in the scenario of geometrical and topological engineering.

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Date submitted: 11 Nov 2014 Electronic form version 1.4