Current-induced runaway vibrations in dehydrogenated graphene nanoribbons

We employ a semi-classical Langevin approach to study current-induced atomic dynamics in a partially dehydrogenated armchair graphene nanoribbon. All parameters are obtained from density functional theory. The dehydrogenated carbon dimers behave as effective impurities, whose motion decouples from the rest of carbon atoms. The electrical current can couple the dimer motion in a coherent fashion. The coupling, which is mediated by nonconservative and pseudo-magnetic current-induced forces, change the atomic dynamics, and thereby show their signature in this simple system. We study the atomic dynamics and current-induced vibrational instabilities using a simplified eigen-mode analysis. Our study illustrates how armchair nanoribbons can serve as a possible testbed for probing the current-induced forces.