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Inelastic carrier lifetime in a coupled graphene electron-phonon system: Role of plasmon-phonon coupling[1] HONGKI MIN, SEONGJIN AHN, Department of Physics and Astronomy and Center for Theoretical Physics, Seoul National University, E.H. HWANG, SKKU Advanced Institute of Nanotechnology and Department of Physics, Sungkyunkwan University — We calculate the inelastic scattering rates and the hot electron inelastic mean free paths for both monolayer and bilayer graphene on a polar substrate. We study the quasiparticle self-energy by taking into account both electron-electron and electron-surface optical (SO) phonon interactions. In this calculation the leading order dynamic screening approximation (G_0W approximation) is used to obtain the quasiparticle self-energy by treating electrons and phonons on an equal footing. We find that the strong coupling between the SO phonon and plasmon leads to a new decay channel for the quasiparticle through the emission of the coupled mode, and gives rise to an abrupt increase in the scattering rate, which is absent in the uncoupled system. In monolayer graphene a single jump in the scattering rate occurs, arising from the emission of the low energy branch of the coupled plasmon-phonon modes. In bilayer graphene the emission of both low and high energy branches of the coupled modes contributes to the scattering rate and gives rise to two abrupt changes in the scattering rate. The jumps in the scattering rate can be potentially used in the hot electron device such as switching devices and oscillators. Ref) Seongjin Ahn, E. H. Hwang, and Hongki Min, arXiv:1409.8394.

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