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Simulating Lattice Image of Suspended Graphene Taken by Helium Ion Microscopy[1] YOSHIYUKI MIYAMOTO, Nanosystem Res. Labs., AIST, HONG ZHANG, College of Physical Science and Technology, Sichuan University, ANGEL RUBIO, Department of Materials Science, University of the Basque Country — Atomic scale image in nano-scale helps us to characterize property of graphene, and performance of high-resolution transmission electron microscopy (HRTEM) is significant, so far. While a tool without pre-treatment of samples is demanded in practice. Helium ion microscopy (HIM), firstly reported by Word *et. al.* in 2006, was applied for monitoring graphene in device structure (Lumme, *et. al.*, 2009). Motivated by recent HIM explorations, we examined the possibility of taking lattice image of suspended graphene by HIM. The intensity of secondary emitted electron is recorded as a profile of scanned He^+-beam in HIM measurement. We mimicked this situation by performing electron-ion dynamics based on the first-principles simulation within the time-dependent density functional theory. He^+ ion collision on single graphene sheet at several impact points were simulated and we found that the amount of secondary emitted electron from graphene reflected the valence charge distribution of the graphene sheet. Therefore HIM using atomically thin He-beam should be able to provide the lattice image, and we propose that an experiment generating ultra-thin He^+ ion beam (Rezeq *et. al.*, 2006) should be combined with HIM technique.

[1]All calculations were performed by using the Earth Simulator.

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