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Electric Field Effects on Electronic Structures of Epitaxial Graphene on SiC HYUNGJUN LEE, Department of Physics and IPAP, Yonsei University, SEUNGCHUL KIM, JISOON IHM, Department of Physics and Astronomy, Seoul National University, YOUNG-WOO SON, Korea Institute for Advanced Study, HYOUNG JOON CHOI, Department of Physics and IPAP, Yonsei University — We report first-principles calculations of atomic and electronic structures of epitaxial single-layer graphene on Si-faced SiC(0001) surface under homogeneous transverse electric fields. We find that atomic positions are insensitive to applied electric fields, but the electronic band structures of the graphene layer are shifted in energy, depending strongly on the applied electric fields, while those of the buffer layer are almost unchanged. This effect finally results in field-induced closing of the energy gap at the Dirac energy point and recovery of the conic feature of the low-energy band structures of free-standing graphene, which are verified and analyzed further with a tight-binding model. The recovery of conical dispersion of the single-layer graphene and ambipolar field-effect behavior makes epitaxial single-layer graphene one of the promising alternatives to current state-of-the-art transistors for radiofrequency applications. This work was supported by the NRF of Korea (Grant No. 2009-0081204). Computational resources have been provided by KISTI Supercomputing Center (KSC-2008-S02-0004).

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