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Highly electron-emitting states of boron-nitride nanotubes derived from the free-electron-like conduction band states[1] BINGHAI YAN, Center for Advanced Study, Tsinghua University, Beijing, 100084, China, CHANG-WON PARK, JISOON IHM, Department of Physics, Seoul National University, Seoul 143-747, Korea, GANG ZHOU, WENHUI DUAN, Center for Advanced Study, Tsinghua University, Beijing, 100084, China, NOEJUNG PARK, Department of Applied Physics, Dankook University, 44-1, Jukjeon-dong, Yongin-si, Gyeonggi-do, 448-701, Korea — We investigate electronic structures and field emission properties of boron-nitride nanotubes(BNNTs) using the first-principles method and electron dynamic simulations. To introduce a feasible transport channel we choose to dope alkali atoms to BNNTs. We show that the nearly free electron (NFE) state could shift down to the Fermi level, preserving the free-electron-like dispersion along the axial direction. Meanwhile the downshifted NFE state bears s-wave characters, which is necessary for an efficient electron field emission. Our dynamic simulations of emission current reveal that the BNNTs are much favorable for electron field emission, owing partially to the presence NFE states as well as low electron affinity. We suggest that a high-performance field emission devices could be fabricated using n-type doped BNNTs.

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