Short Channel SB-FETs의 Schottky 장벽 Overlapping

최창용, 조원주, 정홍배, 구상모
광운대학교 전자재료공학과

Schottky barrier overlapping in short channel SB-MOSFETs.

Chang-Yong Choi, Won-Ju Cho, Hong-Bay Chung, Sang-Mo Koo
Department of Electronic Materials, Kwangwoon University, Seoul 139-701 Korea.

Abstract : Recently, as the down-scailing of field-effect transistor devices continues, Schottky-barrier field-effect transistors (SB-FETs) have attracted much attention as an alternative to conventional MOSFETs. SB-FETs have advantages over conventional devices, such as low parasitic source/drain resistance due to their metallic characteristics, low temperature processing for source/drain formation and physical scalability to the sub-10nm regime. The good scalability of SB-FETs is due to their metallic characteristics of source/drain, which leads to the low resistance and the atomically abrupt junctions at metal (silicide)-silicon interface. Nevertheless, some reports show that SB-FETs suffer from short channel effect (SCE) that would cause severe problems in the sub 20nm regime.[Ouyang et al. *IEEE Trans. Electron Devices* 53, 8, 1732 (2007)] Because source/drain barriers induce a depletion region, it is possible that the barriers are overlapped in short channel SB-FETs. In order to analyze the SCE of SB-FETs, we carried out systematic studies on the Schottky barrier overlapping in short channel SB-FETs using a SILVACO ATLAS numerical simulator. We have investigated the variation of surface channel band profiles depending on the doping, barrier height and the effective channel length using 2D simulation. Because the source/drain depletion regions start to be overlapped each other in the condition of the L_{ch}~80nm with N_D~$1x10^{18}cm^{-3}$ and $\phi_{Bn} \approx 0.6eV$, the band profile varies as the decrease of effective channel length L_{ch}. With the L_{ch}~80nm as a starting point, the built-in potential of source/drain schottky contacts gradually decreases as the decrease of L_{ch}, then the conduction and valence band edges are consequently flattened at L_{ch}~5nm. These results may allow us to understand the performance related interdependent parameters in nanoscale SB-FETs such as channel length, the barrier height and channel doping.

감사의 글

This work was supported by the Korea Research Foundation Grant funded by the Korean Government (MOEHRD) (KRF-2007-3310173)