422. Title:Improved negative differential mobility model of GaN and AlGaN for a terahertz Gunn diode

Authors:Yang, Lin-An (1); Hao, Yue (1); Yao, Qingyang (1); Zhang, Jincheng (1)

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Abstract:This paper presents an improved negative differential mobility model for GaN and AlGaN to simulate GaN Gunn diodes at terahertz frequencies. Temperature-dependent parameters νsat, Ec, α, δ, and γ are proposed to improve the accuracy of the mobility model at high temperatures. In particular, an Al-composition-related coefficient fZ(x) and a random-alloy-potential-related factor f alloy(p) are developed for an AlGaN mobility model. Simulation results show that notched doping GaN and AlGaN/GaN heterostructure Gunn diodes, both including 0.6-μm transit and 0.2-μm electron launching regions, have the capability of generating fundamental frequencies of 352-508 and 332-469 GHz, respectively, with a maximum radio-frequency (RF) power density of ∼ 1010W/cm3 and RF efficiency of over 2% accompanied with a shift of an oscillation mode from a dipole-domain mode toward an accumulation mode as the temperature rises from 300 to 500 K.