ELECTRICAL AND HIGH-FREQUENCY PROPERTIES OF COMPENSATED GaN UNDER ELECTRON STREAMING CONDITIONS

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S u m m a r y

Conditions required for the streaming effect and the optical-phonon transit-time resonance to take place in a compensated bulk GaN are analyzed in detail. Monte Carlo calculations of the high-frequency differential electron mobility are carried out. It is shown that the negative dynamic differential mobility can be realized in the terahertz frequency range, at low lattice temperatures of 30–77 K, and applied electric fields of 3–10 kV/cm. New manifestations of the streaming effect are revealed, namely, the anisotropy of the dynamic differential mobility and a specific behavior of the diffusion coefficient in the direction perpendicular to the applied electric field. The theory of terahertz radiation transmission through the structure with an epitaxial GaN layer is developed. Conditions for the amplification of electromagnetic waves in the frequency range of 0.5–2 THz are obtained. The polarization dependence of the radiation transmission coefficient through the structure in electric fields above 1 kV/cm is found.