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Hot electron engineering for boosting electroluminescence efficiencies of silicon-rich nitride light emitting devices

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Abstract

The combination of a SiO₂ electron accelerator layer with a silicon-rich nitride layer forming a bilayer embedded in a metal-oxide-semiconductor structure has proved to enhance the integrated visible-infrared EL intensity by more than two orders of magnitude in comparison to the single-layer electroluminescent device approach. The origin of such an improvement is attributed to the massive ionization of defects in the silicon-rich nitride layer by direct impact of injected hot electrons coming from the SiO₂ conduction band. Our premises are further corroborated by performing a thorough study of the charge transport in the bilayer structure. This study displays a main electrical mechanism at steady state that combines hot-electron tunneling injection from the SiO₂ accelerator layer and space charge-limited current enhanced by Poole-Frenkel conduction from the silicon-rich nitride electroluminescent layer. The proposed electrical mechanism is validated by numerical simulations that provide good

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