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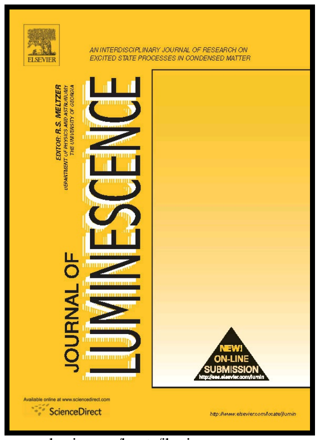

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PII: S0022-2313(16)31312-6
DOI: http://dx.doi.org/10.1016/j.jlumin.2016.11.020
Reference: LUMIN14358

To appear in: *Journal of Luminescence*

Received date: 22 September 2016
Revised date: 4 November 2016
Accepted date: 5 November 2016

Cite this article as: Y. Berencén, B. Mundet, J.A. Rodríguez, J. Montserrat, C Domínguez and B. Garrido, Hot electron engineering for boostin electroluminescence efficiencies of silicon-rich nitride light emitting devices *Journal of Luminescence,* http://dx.doi.org/10.1016/j.jlumin.2016.11.020

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

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Abstract

The combination of a SiO_2 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 SiO_2 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 SiO_2 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