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Citation: Appl. Phys. Lett. **97**, 166102 (2010); doi: 10.1063/1.3499663
View online: http://dx.doi.org/10.1063/1.3499663
View Table of Contents: http://aip.scitation.org/toc/apl/97/16
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Response to "Comment on 'Carrier recombination near threading dislocations in GaN epilayers by low voltage cathodoluminescence'" [Appl. Phys. Lett. 97, 166101 (2010)]

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(Received 9 September 2010; accepted 15 September 2010; published online 18 October 2010)

[doi:10.1063/1.3499663]

The authors are aware that there are number of theoretical models available to simulate cathodoluminescence (CL) contrast as a function of the distance, r, from a nonradiative defect. In our letter[1] a simple expression, $C(r)=C_0 \exp(-r/L)$, was chosen to compare the diffusion length, L, from GaN samples with different n-doping levels over a range of low electron beam energies. This approach is widely used in other studies of CL dislocation contrast as pointed out in the comment on the letter and it was found to provide an acceptable fit to the experimental CL contrast data.

None of the existing CL contrast models have been tested and validated experimentally in low voltage CL studies of dislocation contrast, in particular in their use to analyze CL intensity profiles close to the core of a threading dislocation in GaN. Given this, the application of a simple one dimension diffusion model seemed appropriate and practical in our CL contrast analysis. Indeed, an exponential-like form would also apply if the dislocation core was charged leading to an additional carrier drift current.

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It should also be noted that Jakubowicz's model[2,3] used in the comment[4] to question our measurement approach employs the method of mirror images, which, as pointed out by Jakubowicz, is only applicable for suitably large source-to-image distances.[2,3] This condition, however, is clearly not satisfied with low voltage (1 kV) CL where the source-to-defect distance is of the order of the defect effective radius.

Finally the main purpose of the letter was to confirm that at very low excitation energies the electron-solid interaction volume can be treated as a point source of carriers and consequently the effects of carrier diffusion must be considered in interpreting the CL contrast around point defects in GaN. Since the same analysis method was used throughout the study, the conclusions reached in the paper are still valid, despite the approach only providing a "crude estimation" of the diffusion length.

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