

# Low-temperature cathodoluminescence investigations of GaN nanowires with $\text{Al}_x\text{Ga}_{1-x}\text{N}$ insets

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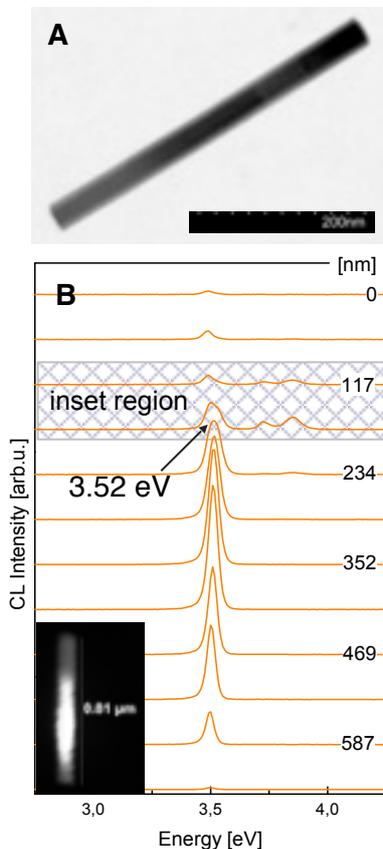
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In this work we present the nano-scale correlation of morphology, structural and optical properties of GaN/ $\text{Al}_x\text{Ga}_{1-x}\text{N}$  based nanowires with the use of scanning electron microscopy and cathodoluminescence spectroscopy (CL).



(A) SEM (TE) image and (B) CL linescan and panchromatic map of GaN nanowire with  $\text{Al}_{0.2}\text{Ga}_{0.8}\text{N}$  inset. Luminescence localisation below the inset is visible.

GaN nanowires (600-800 nm long) with  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  insets were grown on in-situ nitridized Si(111) substrates without catalyst by plasma-assisted molecular-beam epitaxy [1]. To avoid intermixing on the GaN- $\text{Al}_x\text{Ga}_{1-x}\text{N}$  interfaces, between each segment of the nanowire a growth interruptions were applied. Al content within  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  inset as well as the thickness of the inset were varied in subsequent samples.

Morphology, structure of nanowires and luminescent properties were examined with the use of scanning electron microscope (SEM) (with transmitted electron (TE) detector) equipped with cathodoluminescence (CL) system with liquid helium cryo-stage.

CL maps and linescans along the individual nanowires taken at temperature 80 K have shown a strong localized luminescence below the  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  insets. The strong blue-shifted near-band emission (3.50-3.54 eV) of GaN base, (below the inset) can be related to compressive strain existing on the GaN base/inset interface and unintentional Al-rich shell surrounding GaN base of the NW [2].

Spectral features characteristic for NW ensembles and individual NWs, as well as the differences between them are discussed.

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[1] A. Wierzbicka et al. Nanotechnology **24**, 035703 (2013)

[2] L. Rigutti et al. PRB **83**, 155320 (2011)