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CATHODOLUMINESCENCE AT THE VICINITY OF DEFECTS IN III-NITRIDES

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Unique properties of III-nitrides such as high dielectric breakdown voltage, chemical and thermal stability, tunable bandgap allowing spectral coverage from IR to UV make them attractive materials for applications in the fields of microelectronics and optoelectronics. Quantum efficiency and spectral characteristics of semiconductors are highly influenced by defects introduced during growth.

The aim of this work was to investigate defect influence on spectral properties and to find correlation between peak wavelength and integrated intensity of various III-nitride materials using hybrid technique of scanning electron microscopy and cathodoluminescence spectroscopy. The Attolight Chronos SEM-CL microscope was used for analysis, and Python code correlated cathodoluminescence intensity with peak wavelength which was evaluated by Pearson's coefficient.

It was found that in InGaN and AlGaN samples, defects like dislocations and stacking faults induce morphology changes, influencing alloy or quantum well fluctuations resulting in peak wavelength shifts at the vicinity of these sites. It was observed that optical properties and correlation between peak wavelength and CL intensity in GaN samples are highly influenced by density of point defects. It was also shown that energy shifts in all samples can occur due to tensile and compressive strain region formation around dislocations and atom segregation phenomenon.

This study emphasizes the complex interplay between defects and material properties which provides valuable insights for optimizing III-nitride devices.