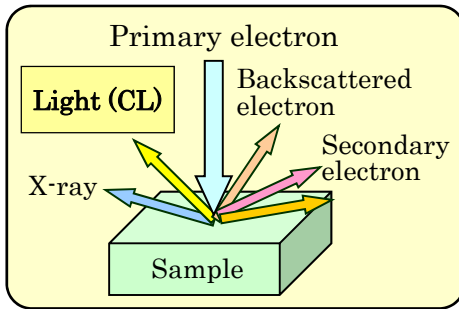


Evaluation of defects in semiconductor devices by advanced high-speed and sensitive CL system

We have developed advanced cathodoluminescence (CL) equipment with a completely new concept. The equipment is suitable for defect characterization of semiconductor devices since it has fully optimized electron gun and high-speed and sensitive spectral mapping system.

Features and applications of newly developed CL system



1. Surface analysis at nm level by low-acceleration and large-current electron gun.
2. High-speed and sensitive spectrum mapping using fully optimized spectroscopic system and software (wavelength distribution, width distribution, intensity distribution etc.)

Applications

Defect characterization of ultrathin film, process damage evaluation (dry etching, ion implantation, etc.), stress, composition ratio, failure analysis (LED, LD, HEMT, SiC power, etc.), nano structure, ceramics, oxide semiconductor, etc.

Components and specifications of the equipment

Schottky emission low-acceleration, high-current SEM (JEOL)
+ High-speed and sensitive UV-Vis-NIR CL spectroscopic system (HORIBA: customized)

Wavelength range: 200–1600 nm
Electron-beam accelerating voltage: 0.05–30 kV
Maximum beam current: 300 nA

High-speed spectrum mapping

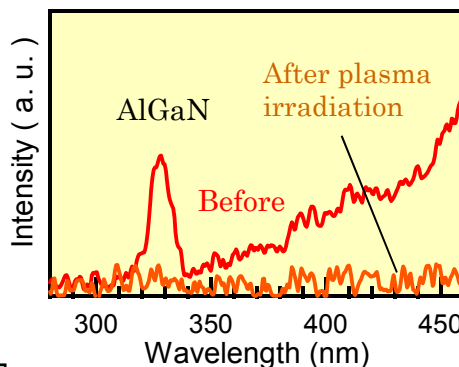
Sample: ZnO particle
Accelerating voltage: 3kV
(penetration depth: 90nm)
50 μm



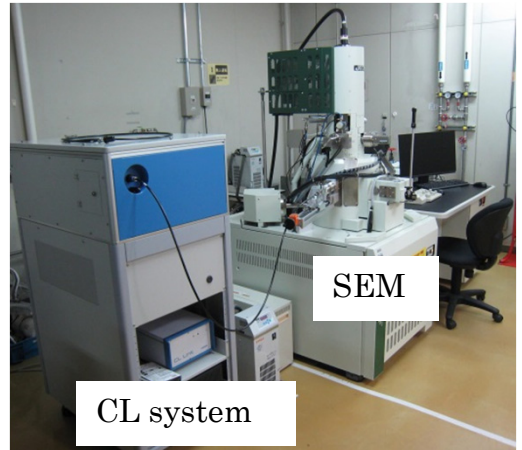
- 401 x 401 pixels (Total 160,801)
- Spectra at all pixels are stored and can be analyzed.
- Peak position, width, and peak intensity mappings are easily obtained.

AlGaIn(35nm)/GaIn HEMT

(Joint research with Prof. Araki at Ritsumeikan University)
Accelerating voltage: 0.5 kV
(penetration depth 4.6 nm)



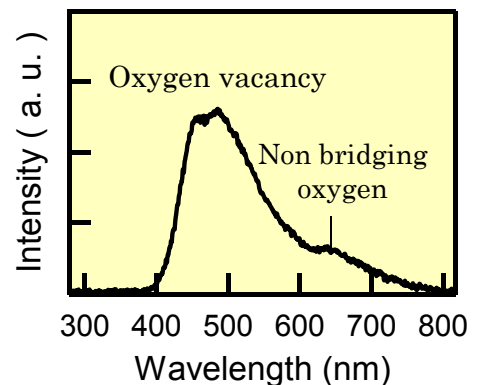
- After plasma irradiation, the near-band-edge emission from AlGaIn layer disappeared.
- **Damage by plasma process is evaluated by the CL intensity decay.**



CL system

SiO₂ film (8nm) on Si substrate

Accelerating voltage: 1.0kV
(penetration depth: 32nm)



- **CL signal from ultrathin film can be detected even if the signal of substrate is strong.**
- It is suitable for SiO₂ and SiN ultrathin films on SiC and GaN substrates.