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.)

### 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**

- **AlGaN(35nm)/GaN HEMT**
  - (Joint research with Prof. Araki at Ritsumeikan University)
  - Accelerating voltage: 0.5 kV (penetration depth 4.6 nm)

- **SiO2 film (8nm) on Si substrate**
  - Accelerating voltage: 1.0kV (penetration depth: 32nm)

- **Oxygen vacancy**
  - Non bridging oxygen

- **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.

- **CL system**
  - 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.

- **Sample:** ZnO particle
  - Accelerating voltage: 3kV (penetration depth: 90nm)

- **AlGaN(35nm)/GaN HEMT**
  - After plasma irradiation, the near-band-edge emission from AlGaN layer disappeared.
  - Damage by plasma process is evaluated by the CL intensity decay.

- **SiO2 film (8nm) on Si substrate**
  - CL signal from ultrathin film can be detected even if the signal of substrate is strong.