

Temperature-dependent photoluminescence (PL) measurement from low to high temperature

Photoluminescence (PL) is an emission of light as a result of light absorption. PL spectra reflect electronic state, defects, and impurities in materials. Wide-bandgap semiconductors show strong temperature dependence at relatively high temperatures. An example of GaN crystal is presented.

PL spectra of GaN from low to high temperature

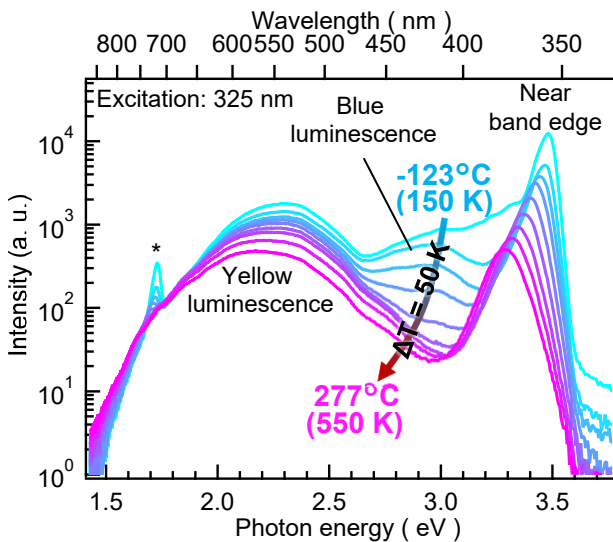


Fig. 1 PL spectra of GaN at various temperatures.

Specifications

Temperature range	-150–300°C (Optional: 25 K-RT)
Excitation wavelength	325, 514.5, 632.8 nm, etc.
Spectral range	340–1600 nm
Sample size	~1 cm square (maximum)
Resolution	< 10 μmΦ
Atmosphere	Vacuum, inert gas, etc.

Intensity, wavelength, and width of PL bands change with temperature.

Examples of temperature-dependent PL measurement

Intensity

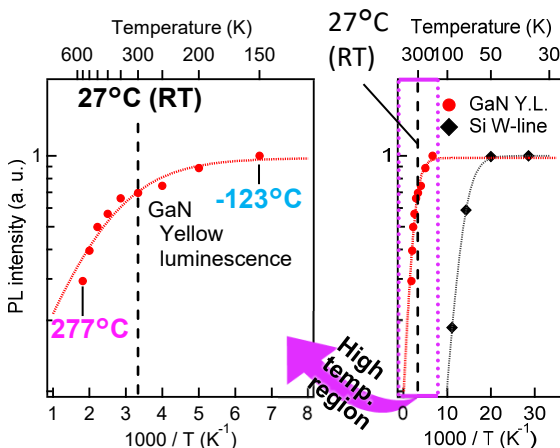


Fig. 2 Temperature dependence of PL intensity.

The intensity of GaN yellow luminescence decreased near RT and high temperatures, while the Si W-line dropped at low temperature. PL measurement at high temperature is useful for the analysis of wide-bandgap materials.

Wavelength (Energy)

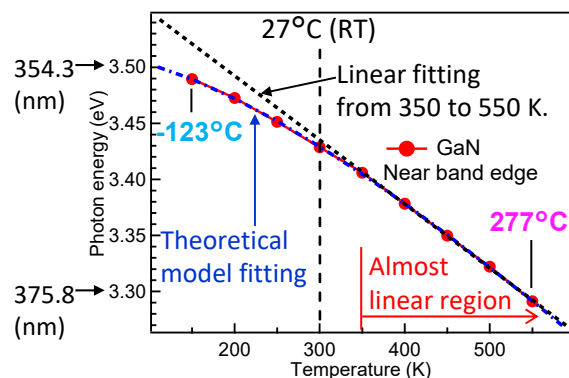


Fig. 3 Peak energy of GaN near-band edge.

The peak position of near-band-edge emission shifted toward lower energy (longer wavelength) as temperature increased. The temperature dependence of bandgap energy can be obtained by the PL measurement.