Photoluminescence maps of surface defects in β-Ga_2O_3

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Monoclinic gallium oxide (β-Ga_2O_3) is an ultrawide bandgap semiconductor with potential applications in power electronics [1]. Photoluminescence (PL) spectroscopy is an important method to characterize dopants and defects in this material. Common features in the PL spectrum include the intrinsic UV band (Fig. 1), blue and green bands that involve donor-acceptor pairs, and red emission due to Cr^{3+} impurities.

PL mapping with excitation wavelengths ranging from 266 to 532 nm reveals the spatial distribution of these features with micron resolution. In Czochralski-grown β-Ga_2O_3, the Cr^{3+} emission intensity shows striations that are attributed due to inhomogeneities during growth [2]. In addition to defects in the bulk, PL microscopy has revealed several specific defects on the surface. Some of these localized centers are very bright UV emitters [3].

Homoepitaxial layers show defects that are observed via the shifts in the PL band, likely due to the strain field around a dislocation core. Damage due to high-intensity laser pulses results in significant changes in the intensity and energy of the UV band (Fig. 2). *In situ* PL spectroscopy performed with a pulsed 266 nm laser shows characteristic emission peaks attributed to Ga atoms ablated from the surface.

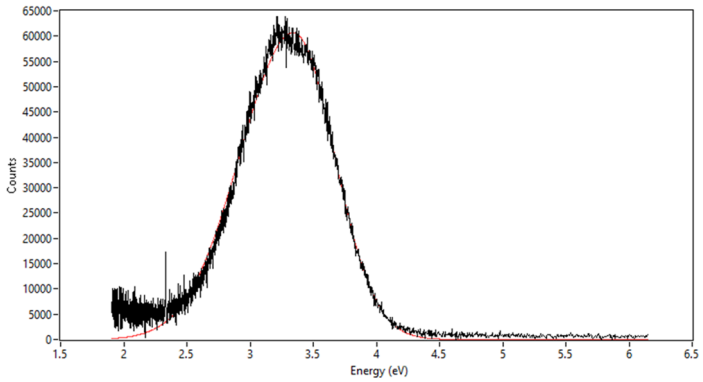

Fig. 1. UV band emission from β-Ga_2O_3 epilayer (266 nm excitation, room temperature).

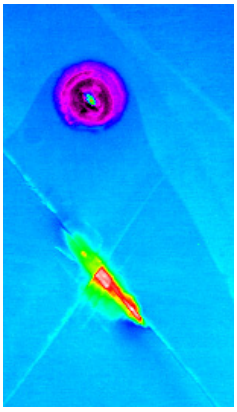

Fig. 2. PL map of the UV-band intensity for a damaged β-Ga_2O_3 epilayer (image width ~ 0.8 mm).

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