Direction Of Excited Carriers From Low In A Facet Of Ingan Microcrystals Observed In The Highly Spatially Resolved Cathodoluminescent Images

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Low acceleration voltage (less than 100 V) field emission displays are required for next generation flat panel displays with low energy consumption. InGaN blue cathodoluminescent phosphor is a promising material in this application field because of its high luminescence efficiency and high conductivity. We have been working on synthesizing InGaN microcrystals for CL phosphors. We have obtained violet phosphors peaking at 420 nm, however, it is difficult to obtain blue phosphors. To increase In content in an InGaN micrcrystal, violet InGaN phosphors are mixed with indium sulfide and nitrided with ammonia between 800 and 1000 C. Samples showing blue CL were obtained with very low yield and were observed under a scanning electron microscope with a high spatial resolution CL graph.

CL spectra obtained from the grown InGaN crystals showed double peaked spectrum at 420 and 460 nm. CL peaks between the two peaks were rarely observed. It seemed that the InGaN grows with stepped increase in In content.

Highly spatially resolved monochromatic CL images at 420 and 460 nm show single peaked spectra for different facets of a crystal. Facets containing low In content emitted CL peaking at 420 nm and those containing high In content at 460 nm. By. comparing two monochromatic CL images for a facet, bright and dark patterns are almost complementary each other. There are differences at some areas, however, the width of a dark zone in the 420 nm CL image was wider than that of the complementary bright zone in the 460 nm image of a low In content facet. If we assume that the rim of the facets with low In content was covered by the layer with high In content, the difference in the widths was explained by the diffusion of excited carriers from the low In content region to the high In content region. The direction of the diffusion is opposite to that inferred from the decay time of CL for InGaN/GaN SQW. The reason of the contradiction is now under concideration.

1)Bell et.al. APL. 84, 58 (2004).