Zn:GaN/AlGaN 量子井戸発光スペクトルにおける鋭い発光ピークの観察

Observation of sharp emission lines in the photoluminescence spectrum of a Zn doped GaN Quantum well

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III-Nitride materials are finding much use in the realization of several solid state light emitting devices such as high-performance lasers with low threshold current, and, of course, LEDs. Furthermore, quantum sources of light, such as single photon emitters, are currently being heavily researched. To date, III-nitride QDs have been studied for such single photon emission, but other possible sources of III-nitride based quantized emission have so far received little attention. Here, we report our attempts to isolate the emission from a single Zn dopant based emission center in GaN for single photon emission in the blue visible region of the electromagnetic spectrum.

Zinc doped GaN/AlGaN quantum wells were grown using metalorganic chemical vapor deposition (MOCVD) as shown in figure 1. The sample contains a GaN quantum well layer sandwiched by two AlGaN bulk structures, the white spots in the figure represent the zinc, which is randomly distributed in the sample. We note that we could not measure the exact doping density of the Zn. The sample was held in a closed circle cryo-optical table system and cooled down to a temperature of 7K. A continues wave (CW) laser with 355nm wavelength (just above the GaN bandgap) was used to selectively excite charge carriers into the quantum well. Under these conditions, we observed a typical broad emission ranging from 400~450nm, related to Zn dopants. In addition, for low density doped samples, we were also able to observe sharp Lorentzian-shaped emission lines on top of the background, with linewidths down to ~500 μeV. This observation provides us with hope that we will be able to isolate single photon emission from such samples in the future.

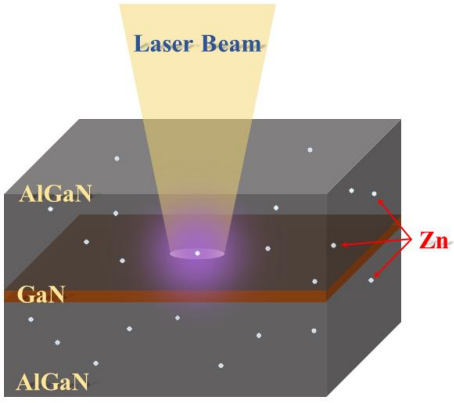

Figure 1: Cross section of the zinc nanostructures on GaN quantum well.

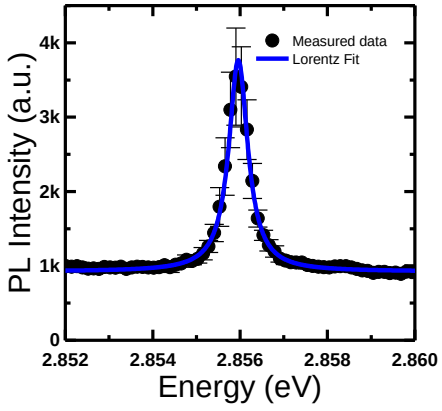

Figure 2: Photonluminescence from the zinc simple substances with linewidth of ~500 μeV.

Acknowledgements: This work was supported by JSPS KAKENHI project 17K14655, KAKENHI Grant-in-Aid for Specially Promoted Research (15H05700), and also the Takuetsu program of the Ministry of Education, culture, sports, Science and Technology, (MEXT) Japan.