# Properties of Er-doped III-N light-emitting diodes

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We will report on the synthesis of Er-doped quantum well (QW) and their PL properties. The III-N semiconductoring compounds are of particular interest because of their direct band gap and high level of optical activity even under conditions of rather high defect density, which would quench emission in other smaller-gap III-V and wide-gap II-VI compounds. Visible emission between about 400 and 800nm has been obtained from Er-doped InGaN thin epilayers.

Er-doped III-N double heterostructures light-emitting diodes (LEDs) and their electroluminescence (EL) properties will be explained on this report. The device structures were made through a combination of metalorganic chemical vapor deposition and molecular-beam epitaxy (MBE) on c-plane sapphire substrates. The AlGaN layers, with an Al concentration of ~12%, were prepared by MOCVD and doped with Si or Mg to achieve n-type and p-type conductivity. The Er+O-doped GaN active region was grown by MBE and had a thickness of 50nm. The Er concentration was decided to be ~$10^{18}$ cm $^{-3}$ . The multi-layer n-AlGaN/GaN: Er/p-AlGaN structures were accomplished into LEDs using standard etching and contacting methods.

A few different LEDs were produced and EL spectra were recorded with both forward and reverse bias conditions. The EL on reverse bias was five to ten times more strong than on forward bias. The LEDs displayed lots of narrow emission lines representative of the GaN: Er system (green; 539 nm, 559nm; infrared:1000nm, 1530 nm). The green emission was visible on ambient room conditions at 330 K when some current crowding was measured. The emission lines increased in intensity and had a narrower linewidth, at cryogenic temperatures. EL emission were observed down to 10 K and the L-I characteristics were measured. We get the power of LEDs about 2.5 W/$m^2$ at 300k. LDEs were grown by metalorganic chemical vapor deposition (MOCVD) on sapphire (0001) substrates with low temperature GaN nucleaton layers.