Thin Film MBE Growth and Characterization of Rare Earth Doped GaN

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Abstract

Thanks to pioneering works, which have been carried out during the last 3 decades, GaN and its alloys formed as combined with indium (In) and aluminum (Al) became indispensable materials for novel optical applications such as green, blue and ultra violet (UV) light emitting diodes (LEDs), laser diodes (LDs), etc. Splendid accomplishments attained by single or multi-quantum well (SQW, MQW) structures using InGaN led to the commercialization of devices mentioned above, and InGaN still plays a pivotal role in these optical applications.

Red emission based on GaN, however, has not yet been (although it has been demonstrated by Zn-doped GaN in early '70s) realized commercially, due to the difficulty of increasing In content in InGaN. If RGB (red, green, blue) emission would be achieved monolithically, the fabrication process of full color display based on GaN would become much simpler, and more efficient white light LED with adjustable mood coloring would be possible.

In this dissertation, the author will introduce rare-earths (REs) doping into GaN for the realization of full color emission on GaN based material. REs have long been widely utilized for various optical devices using their narrow-line-width, their almost-host-independent emission properties of intra-4f transition. Magnetic properties for DMS utilization are also an important aspect of RE in GaN.

Researches based on structural, optical, magnetic properties of RE doped GaN were carried out, and this dissertation is a general summarization of those research reseults.

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