Plenary talk

Review on growth, properties, and applications of AlInN

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Contrary to III-V arsenides for which GaAs/AlGaAs heterostructures can be fabricated with nearly lattice-matched condition for the whole Al composition range, group-III nitride semiconductors possess markedly different lattice constant, which might be detrimental for many applications. For instance, AlGaN/GaN two-dimensional electron gas (2DEG) heterostructures may undergo strain relaxation for an Al content exceeding 40%, which limits in some extend their application to high power electronics. On the other hand, optical confinement involving AlGaN layers becomes rapidly an issue when increasing the Al content, although the refractive index contrast remains rather limited.

Then an alternative solution consists in using a wide bandgap III-N ternary alloy, namely InAlN, which can be lattice-matched to GaN for an In content of 17%. Such an alloy exhibits a bandgap around 4.4 eV, which corresponds to that of $Al_{0.46}Ga_{0.54}N$.

In this review, I will first present the growth of InAlN and discuss the structural and optical properties of this peculiar material. N and p type doping will then be addressed. We will see that a lattice-matched light-emitting diode emitting in the UV range can be fabricated on GaN substrate. This demonstrates that true p-type doping can be achieved, as also confirmed by C-V measurements. Finally, potential applications of InAlN in optoelectronics and electronics will be reviewed.