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Study of point defects in group-III nitrides by means of positron annihilation spectroscopy

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Gallium nitride (GaN) and related alloys [(AlGaIn)N] are promising materials for next generation power electronics. For GaN, for example, because of its wide bandgap, high saturation electron velocity, sufficient thermal conductivity, and high breakdown voltage, it yields a higher figure of merit compared with that of other semiconductors for power devices such as Si and SiC. The presence of point defects with high concentration, however, are the major obstacle to fabricate (AlGaIn)N-based devices. Especially, an understanding of the relationship between dopant activation and point defects is one of key topics. Positron annihilation is a powerful technique for characterizing vacancy-type defects in semiconductors. We have used monoenergetic positron beams to probe vacancies in ion-implanted GaN and GaN grown on Si substrate [1—6]. In the presentation, several possibilities of the application of PLEPS to the study of vacancy-type defects in group-III nitrides will be proposed.

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