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Development of high-density radical source and its application to high-speed growth of nitride semiconductors by plasma-assisted molecular beam epitaxy HIROKI KONDO, Nagoya University, YUKINORI KIHEIDA, HIROYUKI KANO, NU EcoEngineering Co. Ltd., YVON CORDIER, CNRS-CRHEA, PHANNARA AING, OLIVIER GRANGE, Riber Co., YURI TSUTSUMI, OSAMU ODA, MASARU HORI, HIROSHI AMANO, Nagoya University — The high-density radical source (HDRS) was developed to improve growth characteristics of plasma-assisted molecular beam epitaxy (PA-MBE) and its film qualities. The growth rate of GaN and InGaN by the PA-MBE is generally much lower than that by a conventional metal organic vapor phase epitaxy (MOVPE). To improve the growth rate of PA-MBE, we have developed the HDRS, which can realize a nitrogen radical density up to $3\text{x}10^{12}$ cm^{-3}. Then, a faster growth rate of 2.5μm/h in GaN homoepitaxy have been performed employing the HDRS. The growth rate of InGaN was also enhanced by this method. In general, mosaicity of the epilayer confirmed using the X-ray omega rocking curve (XRC) increased with increasing In content in the case using the ICP. However, that by the HDRS hardly changed even at the In content of 16%. Incorporation of impurity was also suppressed according to secondary ion mass spectrometry (SIMS) results. Fine and uniform photoluminescence emission was also confirmed at the whole region of substrates. These results indicate high potential of the HDRS to realize the high-rate growth of high quality and high-In content InGaN.

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