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Analysis of GaN damage induced by $Cl_2/SiCl_4/Ar$ plasma
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GaN-based semiconductors are currently used for optoelectronic device applications, such as laser diodes. The fabrication processes have many problems like plasma-induced damage (PID), which degrades the devices' optical characteristics. In this work, we investigated the PID mechanism of GaN. GaN/InGaN/GaN stacked structure was epitaxially grown on a sapphire substrate. The samples were etched by inductively coupled plasma and analyzed by using photoluminescence (PL). By irradiating the $Cl_2/SiCl_4/Ar$ plasma, PL intensity decreased regardless of the etched depth. The remaining GaN is thicker than ion penetration depth (1.3 nm). To ignore the effect of radicals, ions, and UV light by Cl_2 plasma, we also used ion beam apparatus. Samples were also exposed to Cl_2 ion beam without SiO_2 window (UV light and ions), and with (UV light only). PL intensities were decreased in both samples. From these results, we concluded that the UV radiation from the plasma affects damage formation at the InGaN single quantum well. Also, we can see that simultaneously irradiating UV and ions slightly increases the damage. There can be a synergy effect between UV and ions.

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