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**Critical roles of $CF_4$ and $SiCl_4$ plasma treatments on AlGaN/GaN transistor performance** ANIRBAN BASU, ILESANMI ADESIDA, University of Illinois — Advancements of AlGaN/GaN transistors for high speed and high power applications are tied to realization of high quality gate/ohmic contacts. Plasma processing of semiconductor surfaces plays a crucial role in the contact formation process. Our findings indicate that plasma treatments of gate and source/drain regions by $CF_4$ and $SiCl_4$ plasmas, respectively, affect AlGaN/GaN transistor performance significantly. The $CF_4$ plasma incorporates fluorine ions in the AlGaN epilayer that critically affects the contact barrier height and electron transport in the electron gas at the AlGaN/GaN interface. Therefore, important metrics such as leakage current, mobility and sheet concentration can be controlled using plasma conditions. The implications of such plasma treatment in affecting the ultimate device performance will be discussed. Results related to plasma induced effects such as creation of defects and diffusion of fluorine will be presented in the context of AlGaN/GaN transistor performance. The $SiCl_4$ plasma treatment on AlGaN/GaN surface is a complex process that triggers multiple competing phenomena such as introduction of defects, creation of vacancies and implantation of ions. Our observation of enhanced mobility and sheet concentration in $SiCl_4$ plasma treated samples indicate soft ion implantation of silicon. Its implications on ohmic contact formation and other device performances will be discussed.

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