Figure 3-1 Schematic of ICP Etcher
Figure 3-2. Schematic of PEC wet etcher
Figure 3-3. Etch rate as a function of ICP power for InGaN, GaN and AlGaN. The controlled conditions are 10/10 sccm of Cl₂/N₂, 600W of RF power, 2 mtorr for 300 s.
Figure 3-4. Surface roughness as a function of ICP power for In$_{0.37}$Ga$_{0.63}$N, n-GaN and Al$_{0.35}$Ga$_{0.65}$N. The controlled conditions are 10/10 sccm of Cl$_2$/N$_2$, 600W of RF power, 2 mtorr for 300 s.
Figure 3-5. Etch rate as a function of KOH(aq) concentration under 100 mW/cm² of UV exposure.
Figure 3-6. Surface roughness as a function of KOH\(_{(aq)}\) concentration under 100 mW/cm\(^2\) of UV exposure.
Figure 3-7. $I-V$ curves of Schottky diodes after hybrid etch for GaN.
Figure 3-8. $I-V$ curves of Schottky diodes after hybrid etch for AlGaN.
Figure 3-9. Barrier heights ($\Phi_b$) and ideality factors ($n$) of Schottky diodes after hybrid etch for n-GaN.
Figure 3-10. Barrier heights ($\Phi_b$) and ideality factors ($n$) of Schottky diodes after hybrid etch for Al$_{0.15}$Ga$_{0.85}$N.
Figure 3-11. Breakdown voltages ($V_B$) after hybrid etch of Schottky diodes for n-GaN. All samples were etched by ICP with the flow rate of Cl$_2$/N$_2$=10/10 sccm, ICP/RF powers of 600/100 W, pressure 100 mtorr for 60 s followed by PEC etch by 0.04 M KOH$_{(aq)}$ under 100 mW/cm$^2$ of UV exposure.
Figure 3-12. Breakdown voltages ($V_B$) after hybrid etch of Schottky diodes for Al$_{0.15}$Ga$_{0.85}$N. All samples were etched by ICP with the flow rate of Cl$_2$/N$_2$=10/10 sccm, ICP/RF powers of 600/100 W, pressure 100 mtorr for 60 s followed by PEC etch by 0.04 M KOH$_{(aq)}$ under 100 mW/cm$^2$ of UV exposure.
Figure 3-13. Surface morphologies of n-GaN. (a) as-grown, (b) ICP etch only, (c) ICP etch followed by 30 min of PEC etch, and (d) ICP etch followed by 60 min of PEC etch.
Figure 3-14. Barrier heights and ideality factors as a function of ICP etch time for GaN
KOH\textsubscript{(aq)} = 0.04M

UV power density = 100mW/cm\textsuperscript{2}

without any etch

Figure 3-15. Barrier heights and ideality factors as a function of PEC wet etch time for GaN
Figure 3-16. SIMS analysis of Cl atoms in GaN after hybrid etch. The penetration depth of Cl atoms were estimated about 1500 Å.
Figure 3-17. ESCA spectra of Ga atoms in n-GaN after hybrid etch.
Figure 3-18. ESCA spectra of Cl atoms in n-GaN after hybrid etch.