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Reactive Ion Etching of InP and InGaP using Cl₂ gas with CH₄ and Ar Addition

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We studied reactive ion etching (RIE) of InP and InGaP using Cl₂ plasma with/without CH₄ and Ar as a function of the etching parameters, such as gas flow rate, RF power, and process pressure at room temperature. (100) InP substrates and InGaP/GaAs samples grown by molecular beam epitaxy were used in this experiment. For etch mask, a 2500 Å -thick SiO₂ layer deposited by plasma enhanced chemical vapor deposition was used and patterned into 3–5 μm stripes by using conventional photolithography and a CF₄/O₂ RIE. The etching time was set to 10 min. The etch rates were measured by a surface profiler. The etched profiles, sidewall roughness, and surface morphology were examined from scanning electron microscopy (SEM) and atomic force microscopy measurements. Figure 1 shows the etch rates of InP and InGaP and SiO₂ mask erosion rates using only Cl₂ gas as functions of etching parameters. The effects of CH₄ and Ar addition to the Cl₂ plasma were investigated. Figure 2 shows SEM micrographs of InP and InGaP etched under various etching conditions using 20sccm Cl₂. Optimum RIE conditions of InP and InGaP were obtained for optoelectronic device applications which required vertical profiles and smooth surface morphology.

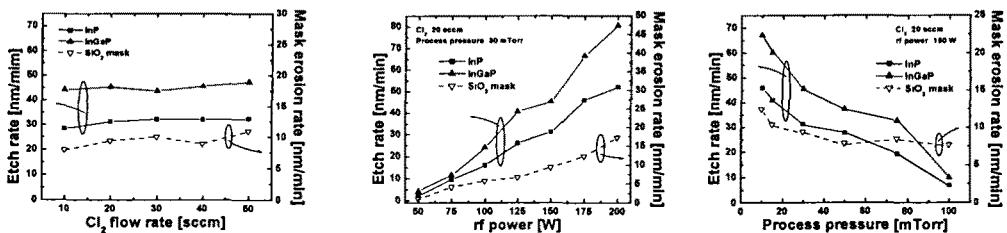


Figure 1.

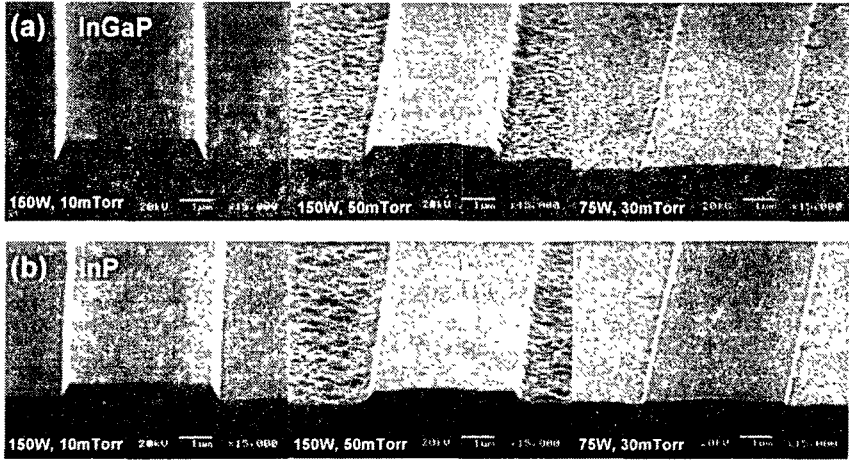


Figure 2.