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Comparison of High Density Plasma Etching of AlGaAs/GaAs and InGaP/GaAs in Planar Inductively Coupled BCl3 Plasmas

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AlGaAs and InGaP are very important semiconductor materials for fabrication of advanced GaAs-based electronic and photonic devices. Currently, GaAs/AlGaAs/GaAs and GaAs/InGaP/GaAs structure are still competing each other for advanced device performance even though the latter has more merits potentially. Regarding pattern transfer process of those materials with scaling-up of GaAs substrate wafers, dry etching process is being preferred to wet etching process due to good process uniformity and high yield as well as environmental issues. For example, the thickness of base layer (either AlGaAs or InGaP) of a GaAs-based HBT structure is generally in the range of 20 - 40 nm. It is required to have a non-selective etch step of AlGaAs/GaAs and InGaP/GaAs layers in order to define a collector region in the HBT devices. Those double-layer structures are also favorable for photonic devices, such as lasers, LEDs and waveguides. We studied high density dry etching of AlGaAs/GaAs and InGaP/GaAs in planar inductively coupled BCl3 plasmas as a function of planar ICP source power, gas flow rate, RIE chuck power and chamber pressure. The process results were characterized in terms of etch rate, surface morphology, residual gas after etching and surface roughness. In general, BCl3 planar ICP etching of AlGaAs/GaAs showed very excellent results, while that of InGaP/GaAs showed somewhat rough surface after etching. We think that InClX by-products was still little volatile during InGaP/GaAs etching in the planar inductively BCl3 plasmas at room temperature.