F-based 플라즈마를 이용한 GaAs/AlGaAs 와 InGaP 반도체의 건식식각에 관한 연구

A study of Dry etching of GaAs over AlGaAs and InGaP Semiconductor in F-based Plasmas

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We investigated selective dry etching of GaAs over AlGaAs and InGaP in high density planar inductively coupled BCl_3/SF_6 and BCl_3/CF_4 plasmas The process parameters were ICP source power (0 - 500 W), RF chuck power (0 - 30 W) and gas composition (60 - 100% BCl_3 in BCl_3/SF_6, BCl_3/CF_4) The process results were characterized in terms of etch rate, selectivities of GaAs over AlGaAs and InGaP, surface morphology, surface roughness and residues after etching BCl_3/SF_6 and BCl_3/CF_4 selective etching of GaAs showed quite good results in this study SF_6 Plasma Selectivities of GaAs (GaAs AlGaAs ~ 36 1, GaAs InGaP ~ 45 1) were superior at BCl_3/CF_4 Plasma Selectivities of GaAs (GaAs AlGaAs ~ 16 1, GaAs InGaP ~ 38 1), 20W RF chuck power, 300W ICP source power and 7 5 mTorr

Addition of (5 -15%)SF_6 or (15%)CF_4 to BCl_3 produced relatively high selectivities of GaAs over AlGaAs and InGaP during etching due to decrease of etch rates of AlGaAs and InGaP Specially addition over 67% CF_4 present definitely low selectivities of GaAs over AlGaAs and InGaP (boiling points of etch products AlF_3 ~ 1300℃, InF_3 > 1200 ℃ at atmosphere) at the condition SEM and AFM data showed slightly sloped sidewall and somewhat rough surface(BCl_3/SF_6 RMS ~ 9 nm, BCl_3/CF_4 RMS ~ 2 nm) It shows that planar inductively coupled F-based plasmas could be a good candidate for selective dry etching of GaAs over AlGaAs and InGaP