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Atom probe characterization of an AlN interlayer within HEMT structures grown by molecular beam epitaxy and metal-organic chemical vapor deposition BAISHAKHI MAZUMDER, STEPHEN W. KAUN, Materials dept, University of California Santa Barbara, JING LU, STACIA KELLER, UMESH K. MISHRA, ECE dept, University of California Santa Barbara, JAMES S. SPECK, Materials dept, University of California Santa Barbara, MATERIALS DEPT, UCSB COLLABORATION, ECE DEPT, UCSB COLLABORATION — An AlN interlayer is introduced in a conventional AlGaN/GaN HEMT to enhance the density and mobility of the two dimensional electron gas (2DEG). MBE and MOCVD are two competitive and proven techniques to grow high quality AlN, but a chemical characterization technique is desired to investigate the purity of the AlN interlayer. Amongst nanoanalyzing techniques, atom probe tomography (APT) is unique for its spatial resolution and 3-D compositional images (< 0.2nm) with analytical sensitivity (10appm). In this work, plasma assisted MBE(PAMBE) and MOCVD techniques were employed to grow AlGaN/AlN/GaN heterostructures. Detailed compositional data from atom probe shows that a pure AlN layer was grown by PAMBE. From Hall measurements, the carrier density (sheet resistance) was found to be 1.65×10^{13}cm^{-3}(188Ω/sq). The MOCVD structures do not form a pure AlN layer but that of $Al_{0.45}Ga_{0.55}N$ layer. The carrier density was found to be 1.15×10^{13}cm^{-3} (425 Ω/sq). This work showed that MBE technique is more suitable than MOCVD for growing pure AlN interlayers and that APT can provide valuable nano scale information for further optimization of growth structures, thereby improving device performance.

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