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Optical properties of AlN epilayers probed by polarization resolved photoluminescence A. SEDHAIN, N. NEPAL, M.L. NAKARMI, J.Y. LIN, H.X. JIANG, Department of Physics, Kansas State University, J.H. EDGAR, Department of Chemical Engineering, Kansas State University — Polar and non-polar AlN homo- and hetero-epitaxial layers were grown on sapphire and AlN bulk substrates by metal organic chemical vapor deposition. Polarization resolved deep ultraviolet photoluminescence (PL) spectroscopy was employed to investigate the optical properties of these samples. For the first time, B and C valence band related free exciton (FX) transitions with a dominant $\mathbf{E}\_\mathbf{c}$ polarization were directly observed from PL. The emission energy peaks of B and C excitons were found to locate at 199 and 212 meV higher than that of the A-exciton transition possessing the $\mathbf{E}|\mathbf{c}$ polarization. A more comprehensive picture of the valence band structure of AlN is thus directly observed from PL measurements. AlN homo-epilayers in all orientations (a-, c-, and m-plane) were found to be strain free and have a nearly identical band gap of 6.099 eV at 10 K. The band edge peak intensity ratios of a-, c-, and m-plane homo-epilayers were roughly 32:5:1 and line width was found to be the smallest in a-plane homo-epilayer. Our results also indicated that built-in electric fields are almost absent in all AlN homo-epilayers.

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