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THz optical Hall-effect and MIR-VUV ellipsometry characterization of 2DEG properties in HfO_2 passivated AlGaN/GaN HEMT structures[1] S. SCHÖCHE, A. BOOSALIS, University of Nebraska-Lincoln, C.M. HERZINGER, J.A. WOOLLAM, J.A. Woollam Co. Inc., J. SHI, W.J. SCHAFF, L.F. EASTMAN, Cornell University, M. SCHUBERT, T. HOFMANN, University of Nebraska-Lincoln — We present non-contact, optical measurements of free-charge carrier mobility, sheet density, and effective mass parameters of the 2DEG for different HfO_2 passivated AlGaN/GaN high electron mobility transistor structures at room temperature. Spectroscopic ellipsometry (SE) in the spectral range from THz and Mid-IR to the VUV and THz optical Hall-effect (generalized ellipsometry in magnetic fields) (OHE) are employed. Changes in the HfO_2 layer growth conditions are found to drastically influence the electron density of the channel. The sheet density and the carrier mobility obtained by the optical investigations are in excellent agreement with results from electrical Hall-effect measurements. The electron effective mass parameters determined here using the OHE corroborate previous SdH and cyclotron resonance studies. The surface sensitivity of VUV-SE in combination with OHE allows for correlation of surface passivation and changes in the 2DEG properties.

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