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Characterization of stress in thin-film wurtzite GaN grown on c-plane sapphire by molecular beam epitaxy. FRANCISCO PARADA, MICHAEL MARCINIAK, Air Force Institute of Technology, LAVERN STARMAN, JASON FOLEY, Air Force Research Laboratory, YUNG KEE YEO, Air Force Institute of Technology — The stress distribution in wurtzite gallium nitride (GaN) grown on c-plane sapphire substrates by molecular beam epitaxy is characterized. Micro (μ)-Raman spectroscopy is particularly useful for stress characterization because of its ability to measure the spectral shifts in Raman peaks in a material, and correlate those shifts with stress and strain. The phonon deformation potential is determined by applying pressure to the material using a four-point strain fixture while simultaneously monitoring the applied pressure using a strain gauge and recording the Raman spectrum. The deformation potentials are then used to determine stress distribution; the spectral positions of the E_2 Raman mode (ν = 569 cm-1) in GaN and A_{1g} Raman mode ($\nu = 418$ cm^{-1}) in sapphire are recorded at each spatial position in a raster map. The μ-Raman spectroscopy is performed using a Renishaw InVia Raman spectrometer with argon ion ($\lambda = 514.5$ nm, hν = 2.41 eV) and helium-neon ($\lambda = 633$ nm, hν = 1.96 eV) excitation sources, and the data is collected across the samples with 5- to 10-μm spatial resolution. Inherent stress and evidence of significant damage in the GaN layer due to MEMS processing will be discussed.

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