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Isotropic dielectric functions of highly disordered $Al_xGa_{1-x}InP$ (0 □ *x* □ 1) lattice matched to GaAs

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Determination of the complex dielectric function and the critical-point energies of $(Al_xGa_{1-x})_{0.51}In_{0.49}P$, over the full range of composition *x* and for photon energies *E* from 0.75 to 5 eV is reported from variable angle of incidence spectroscopic ellipsometry. Native-oxide effects on the $(Al_xGa_{1-x})_{0.51}In_{0.49}P$ optical functions are removed numerically. The highly disordered state of the metalorganic vapor-phase epitaxy grown samples is analyzed by transmission electron microscopy. Optical anisotropy investigations revealed that the order-induced optical birefringence is negligible throughout. The augmentation of A. D. Rakić and M. L. Majewski [J. Appl. Phys. **80**, 5909 (1996)] to Adachi's critical-point model, i.e., consideration of Gaussian-like broadening function instead of Lorentzian broadening, is used for calculation of the isotropic $(Al_xGa_{1-x})_{0.51}In_{0.49}P$ dielectric function ∈. The optical functions spectra consistently match the experimental data, whereas previously reported model dielectric functions fail to reproduce the correct absorption behavior of the quaternary, especially near the fundamental band-to-band transition. The results are compared to those presented previously, and influence of spontaneous chemical ordering is discussed. © *1999 American Institute of Physics.*

KEYWORDS and PACS

Keywords

aluminium compounds, gallium compounds, indium compounds, III-V semiconductors, semiconductor epitaxial layers, dielectric function, ellipsometry, transmission electron microscopy, birefringence, Gaussian distribution, spectral line broadening, optical constants

PACS

78.66.Fd
III-V semiconductors

71.45.Gm
Exchange, correlation, dielectric and magnetic response functions, plasmons

78.20.Ci
Optical constants (including refractive index, complex dielectric constant, absorption, reflection and transmission coefficients, emissivity)

78.20.Fm
Birefringence

68.55.Ln
Defects and impurities: doping, implantation, distribution, concentration, etc.

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