

# **Measurement of the effect of plasmon gas oscillation on the dielectric properties of p- and n-doped Al<sub>x</sub>Ga<sub>1-x</sub>N films using infrared spectroscopy**

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## Abstract:

We report on the application of infrared (IR) spectroscopy as an approach to nondestructive optical method for quantitative measurement of relevant optoelectronic properties in complex multilayer systems. We developed a numerical technique to analyze quantitatively the dielectric properties and plasmon gas characteristics from infrared reflectivity measurements. The developed technique is based on the combination of Kramers-Kronig theorem with the classical theory of electromagnetic wave propagation in a system of thin films. We applied the approach to deduce the dielectric properties and plasmon gas characteristics in p- and n-doped AlGaN alloys of various compositions, deposited on AlN(100nm)/GaN(30 nm)/Al<sub>2</sub>O<sub>3</sub>. The results agreed with the electrical measurements, and the back calculation reproduced satisfactorily the reflectivity measurements, demonstrating the accuracy of the developed technique. VC 2013 AIP Publishing LLC. [<http://dx.doi.org/10.1063/1.4817172>]