Analysis of Current Voltage measurements on Au/Ni/n-GaN Schottky contacts in a Wide Temperature Range.

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Abstract

Current-voltage characteristics of Au/Ni/n-GaN Schottky contacts have been measured in the 60-320 K temperature range. The zero bias barrier height, ϕ_{bo} and ideality factor, n have been studied as a function of temperature. The sharp increase in ideality factor at low temperatures has been explained as an effect of thermionic field emission. The deviation of the characteristics from the ideal thermionic behaviour are more pronounced with a decrease in temperature, in which the results obtained indicate the presence of other current transport mechanisms in the 60-280 K temperature range and the dominance of pure thermionic emission current at 300 K. The increase in barrier height with increasing temperature has been explained as an effect of barrier inhomogeneities.

Keywords

GaN Schottky contacts, Schottky barrier height, thermionic field emission, temperature dependence.

Introduction.

Study of wide band gap materials for applications in low temperature environments e.g satellites as well as high temperature environments of late has been of vast interest. Having a wide, direct band gap and good transport properties, GaN is ideally suited for intrinsic ultraviolet, UV detectors with high responsivities for wavelengths shorter than 365 nm [1]. The electrical characteristics of the GaN devices under these different temperature conditions are essential. GaN also has potential applications in optoelectronic devices operative in the spectral range from blue to UV. Electrical characteristics of metal contacts to n-GaN under different temperature conditions have been studied by many research groups [1,2,3]. Published reports indicate a barrier height of between 0.53-1.03 eV which is dependent on the types of metals used. Guo et al [2] reported a room temperature barrier height of 0.66 eV on Ni Schottky contacts using the IV method, while a barrier height of 0.84 eV was also measured by Hacke et al [3] on Au Schottky contacts by using the IV technique. Temperature dependent IV characteristics of metal Schottky contacts on n-GaN have been studied by