

Comparative Study and Analysis of Si/SiC and GaN/AlGaN Based Pin Diode Photo Sensors

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Abstract: *The research work has been done through a comparative study and analysis of Si, SiC and GaN, AlGaN based pin diode photo sensors. The devices which are made up of grapheme based materials are actually grapheme based materials which have the properties of good optical and good electrical which can be used as photo detection. So the photo sensors made up of grapheme based materials are expected to perform in high speed opto electronic devices. The author has done a comparison in the analysis of Forward characteristics, Carrier mobility, reverse recovery time, isolation loss and insertion loss of the exotic pin based photo detectors of GaN/ AlGaN and Si SiC based devices for opto electronics applications.*

Keywords: Microstrip Patch Antenna (MPA), Ultra-Wide Band (UWB), WLAN, Antenna Design.

I. INTRODUCTION

The super lattice structure of pin diode has been has the advantages of Si/SiC devices than the GaN/ AlGaN The author is here establishing the comparative study of the above mentioned Si and id Ga and its alloys The devices of Si and its alloys are faster reverse recovery time than GaN/ AlGaN devices mostly 9 vs to 35 ns, Actually the early diagnosis of the malignant cells is a very challenging research work in the millimeter and submillimeter regions. The researchers are using the method Spectroscopy , Actually this spectroscopy method is used by the use of photo sensors. Here the author has been working in the comparative study of GaN / AlGaN and S/ SiC based pin diode photo sensors in the properties like reverse recovery time, Insertion loss, Isolation loss, Carrier mobility , junction temperature.

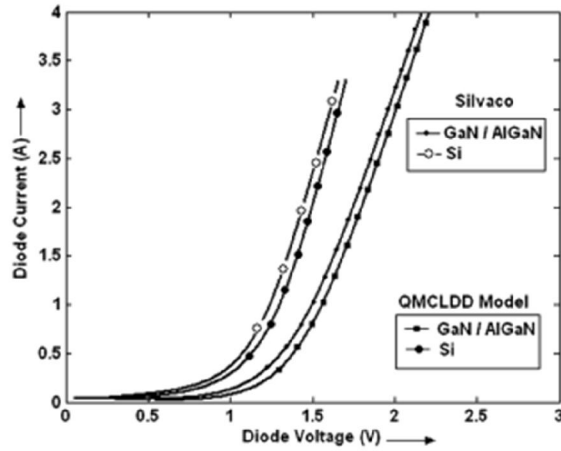
II. RESULT AND ANALYSIS

The Si/ SiC devices have lower forward RF Series resistance, The Si/ SiC switches have less junction temperature than GaN /AlGaN pin switches. The measurement of heat generated at the junction temperature of these type devices which are used as nano scale devices can be measured by COMSOL Software with the process of Thermal Image Analysis.

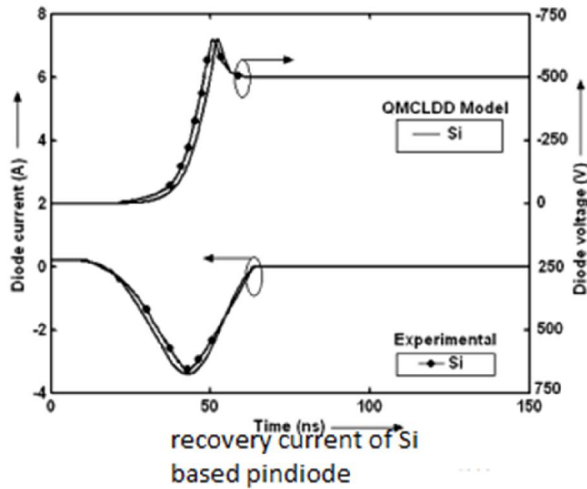
It Has been found the Thermal images of GaN/ Al GaN devices have Actually It has been found that GaN AlGaN devices have better thermal stability than the Si/ SiC devices. The thermal images of GaN/AlGaN devices have been found.

It has been found that the carrier mobility (μ) and Carrier lifetime product (t) of GaN / AlGaN is much higher than Si/SiC as because of Cancellation effect of high carrier mobility and low carrier life time product in the GaN And AlGaN.

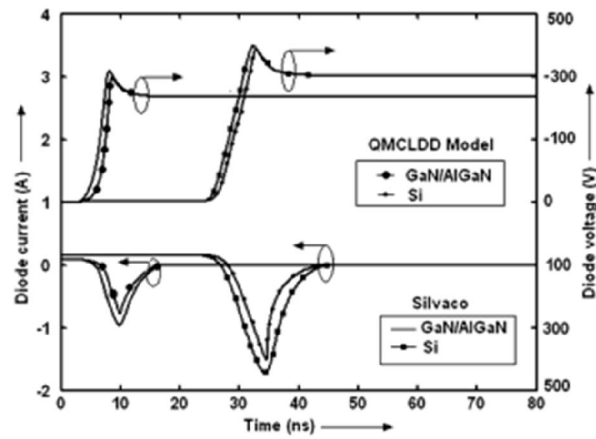
The author has found that lower forward resistance in GaN /AlGaN is because of high carrier mobility. It has been found that the carrier life time can be limited by the recombination process by the use of impurity and alloy scattering in AlGaN layered structure but the carrier life time will be will be approaching to the two dimensional structure. It has al;so found that the the band gap energy and consequently critical value of the Breakdown electric field in GaN are really high , so the properties as RF characteristics is much better than in GaN devices.



Simulated results of DC current for Si and GaN/AlGaIn based pin diodes at room temperature



recovery current of Si based pindiode



reverse recovery current for Si and GaN/AlGaIn based pin diodes

The Dc and RF characteristics of the asymmetrical GaN / AlGa_N supper lattice structured pin devices can be compared. The variation of Dc current with optimum DC voltage for GaN/AlGa_N and Si are shown. The author has found that the GaN / AlGa_N structure is more superior than Si/ SiC structure. It has been found the series resistance of GaN/AlGa_N is found less than the Si/SiC devices in the mm wave range. The Series resistance is low within the frequency range of terahertz.

The author has studied that the high absorption coefficient of GaN/AlGa_N exotic pin photo sensor in Visible Wave length than the Si/SiC pin photo sensors. The power dissipation in GaN/AlGa_N devices is very low compared to its Si based pin diode is much.

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