Calculated of Electron Mobility in InN by Monte Carlo and Iteration Models

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Abstract— ***Electron mobility in InN is calculated using by Monte Carlo and Iteration mode as a function of temperature and the electron density.***

Keywords-*: Iteration model; Monte Carlo; electron mobility.*

I. INTRODUCTION

The III-nitride material system is also suitable for photo electronic device applications. The III–nitrides are particularly useful for ultraviolet (UV) and blue – light photonic emitters and detectors. The III–nitrides offer an additional advantage since heterostructures can be made from these materials. The study of charge transport in semiconductors is of fundamental importance both from the point of view of basic physics and for its application to electronic devices [1]. The performance of semiconductor electronic devices depends on low-field electron transport properties of the materials in which they are fabricated [2]. There are several methods used in the calculation of the transport properties, namely; variational principle (VP), iterative method (IM), relaxation time approximation (RTA), Matthiessen rule (MR) formalism, and Monte Carlo (MC) method [3]. These numerical techniques rely on the discretisation of the semiconductor equations, which were originally derived from approximations based on the Boltzmann transport equation, to obtain solutions. The iterative method described in semiconductors InN, GaN and AlN is expressed in the articles [11-12] .The Monte Carlo method has a quite different methodology, although the solution is still based on the Boltzmann equation. Monte Carlo techniques are statistical numerical methods, which are applied to the simulation of random processes. The low-field electron mobility is one of the most important parameters that determine the performance of a field-effect transistor. The purpose of the present paper is to calculate electron mobility for various temperatures and ionized-impurity concentrations. The formulation itself applies only to the central Γ valley conduction band. We have also consider band non-parabolicity and the screening effects of free carriers on the scattering probabilities All the relevant scattering mechanisms, including polar optic phonons, deformation potential, piezoelectric, acoustic phonons, and ionized impurity scattering. This paper is organized as follows. Details of the Monte Carlo method are presented in section II and the comparison computation the iterative method and the Monte Carlo method carried out on InN structure are interpreted in section III.

II. MODEL DETAILS

The single Monte Carlo Method, as applied to charge transport in semiconductors, consist of a simulation of the motion of one electron inside the crystal subject to applied electric field and given scattering mechanisms.

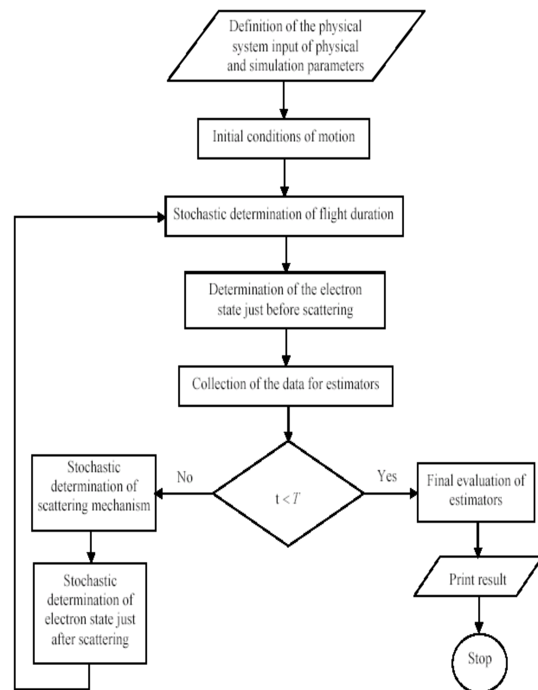

Figure 1.Flowchart of typical Monte Carlo program [10].