

**GeTe Multi-level Phase Change Memory**

**with Separate Heater Layer**

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## **ABSTRACT**

Phase change memory (PCM) is one of the promising technology for future in non-volatile solid state memory. The concept of phase change memory is the changing state from amorphous to crystalline state. The temperature of changing the amorphous to crystalline is differed according to the phase change material. Ge<sub>2</sub>Se<sub>2</sub>T<sub>5</sub> is the common phase change material for phase change memory. However the crystalline state for Ge<sub>2</sub>Se<sub>2</sub>T<sub>5</sub> is (450K-900K). After 900K, the phase change material will melt and become amorphous state. There are few reasons of conducting this project. Firstly, this project is conducting in order to overcome the rapid changes in conventional phase change memory layer which is hardly to control the crystallization process. Then, the implementation of Germanium Telluride and Silicon Carbide (SiC) will be used for the design in order to achieve the multi-level memory. In this project, the phase change memory is designed by using Germanium Telluride as the phase change layer. The top and bottom electrodes for this structure are Titanium Nitride. Then, the heater for this structure is Silicon Carbide and silicon dioxide as the insulator for the structure. The substrate for this structure is Glass (quartz). Figure 1 shows the structure for the design multilevel phase change memory. COMSOL 4.4 will be used for the simulation software. A 100ns SET pulse with time dependent from 0.1 to 3V in order to achieve four bits of multilevel memory.

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# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

Phase change memory (PCM) device is one of the promising device for the replacement of standard floating gate. Generally, phase change memory is simply described as a non-volatile memory device which has the ability to rapidly change from two stable physical states[1]. The states are amorphous and crystalline. During amorphous process, the state of PCM device is in 'reset' whereas the state in crystalline is 'set'[2]. The research of PCM is enhanced over the decades due to high switching mode, low programmable energy, high data retention, and high scalability [3]-[4].

The problem that occur in phase change memory is rapid drop in temperature. When, the set mode is applied to the phase change material layer, the rapid changes of conventional phase change memory is occurred[5]. Due to that, conventional PCM is hardly to control. Thus, the introducing of heater is applied to the PCM device.

In the literature, the data retention that has been proved for PCM is about 10years by using GeSbTe (GST) as the phase change material. Although, Germanium Telluride (GeTe) will use for this research in order to optimization