VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama" Belagavi – 590010

PROJECT REPORT ON

"DESIGN & FABRICATION OF SEMICONDUCTOR DIODE USING PHASE CHANGE MATERIAL (GST) FOR NANOTECHNOLOGY APPLICATION"

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF ENGINEERING
IN
ELECTRONICS & COMMUNICATION ENGINEERING
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CERTIFICATE

Certified that the project work entitled "**DESIGN & FABRICATION OF SEMICONDUCTOR DIODE USING PHASE CHANGE MATERIAL (GST) FOR NANOTECHNOLOGY APPLICATION**" *is a bona fide work carried out by*

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in partial fulfillment for the award of **BACHELOR OF ENGINEERING** in **ELECTRONICS & COMMUNICATION ENGINEERING** of the **VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI** during the year 2019–2020. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the Bachelor of Engineering Degree.

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ABSTRACT

The formation of hetero-junction diode is obtained when a p-type material is deposited on n-type material. The n-type material used is Silicon. Silicon is most abundant compound in the earth's crust, commonly Silicon is found from ordinary sand. The p-type material used is GST (Ge2Sb2Te5 –Germanium, antimony and tellurium) because it is one of the best materials for optical phase-change recordings, and the film is widely utilized in commercial digital versatile disks. The feature of GST is fast (≤50 ns) and highly repeatable (≥106 times) phase changes upon optical heating. The process used for deposition of p-type on n-type material is PVD (Physical Vapor Deposition) or Sputtering. The doping requires sophisticated machines that have to be diffused or implanted some other material into silicon wafers, and then gives a boundary of the diode which acts as a junction. After making contact, the p-n junction diode can be realized. Then, Ellipsometer was used to calculate the deposited thickness. The metallization was done using evaporation method to make the Aluminum metal contact.

The GST material possesses the phase change phenomenon which was realized using the annealing process. In the proposed work, the two samples were prepared to observe the variations on electrical characteristics due to change in thickness. The I-V and C-V measurement were done on the prepared samples to observe the forward/reverse characteristics and interface properties of the device using Kiteley 4200 SCS (Semiconductor-Characterization-System) in order to compare the amorphous and crystalline phases of the GST material. The higher thicknesses gave the appropriate behavior of the diode while the earlier breakdown was observed in lower thickness. The CGST based device produces higher current than the AGST based device.