To understand the set-rest mechanism and thermal stability of $Si_{15}Te_{25}Ge_2$ (GSiT) Phase Change Memory (PCM) material

**EXPERIMENTAL SETUP**

**SAMPLE PREPARATION**

Furnace setup - Quenching Process
1. Furnace, 2-Asbestos powder, 3-Ceramic tube, 4-Motor, 5-Ampoule
   - Total weight of the constituent elements 1.5 g
   - Flattened quartz ampoule dimensions:
     - inner diameter = 5 mm
     - outer diameter = 7 mm
   - Sealed under vacuum at about 10 $^-3$ torr
   - Furnace temperature maintained at 1100 °C
   - Duration 36 h @ 10 rpm of ampoule rotation
   - Melt quenched in NaOH + Ice water mixture

**ELECTRICAL SWITCHING SETUP**

- I-V characteristics recorded using KEITHLEY Source-Meter (model 2410c)
- A constant current of 0-2 mA is passed through the sample and the voltage developed across the sample is measured
- Sample thickness 0.2 mm

**RESULTS**

**ELECTRICAL SWITCHING AND THE SET-RESET PROCESS**

- Memory type switching
- Threshold type switching

**SET-RESET process over several triangular (SET) and a short rectangular pulse (RESET) input currents**

- The SET process in the GSiT sample is achieved by applying a 2 mA triangular pulse for a sample thickness of 0.2 mm. During the ramp-up process of the SET operation, electrical switching from the OFF to ON state occurs at about 100 $\mu$A current and the SET state is reached at the 2 mA ON-state current. During the ramp-down of the applied triangular current pulse, the SET state is retained (memory behavior).
- The electrical resistance in the OFF state is $8-9$ M$\Omega$ and in the SET state is $50-100$ k$\Omega$.
- The RESET process is accomplished by applying a rectangular current pulse of 2 mA magnitude and 10 ms width. This heats up the crystallized conducting channel rapidly and causes the local melting of the conducting channel and its subsequent re-solidification into a high resistance amorphous state.

**CONCLUSIONS**

- The GSiT sample can be easily set and reset over several cycles using a 2 mA triangular SET pulse and a 2 mA short rectangular RESET pulse respectively.
- The only phase responsible for the SET and RESET process is $\alpha$-GeTe or $\epsilon$-GeTe.
- GSiT sample is found to have good thermal stability.

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