

## DOPED SbTe PHASE CHANGE MATERIAL IN MEMORY CELLS

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Phase Change Random Access Memory (PCRAM) is investigated as replacement for Flash. The memory concept is based on switching a chalcogenide from the crystalline (low ohmic) to the amorphous (high ohmic) state and vice versa. Basically two memory cell concepts exist: the Ovonic Unified Memory (OUM) and the line cell. Switching to the high ohmic or low ohmic state is done using Joule heating. A relatively short (~ns) electrical pulse with large amplitude is used to heat the crystalline phase to melt and quench into the amorphous state (RESET). A pulse with smaller amplitude heats the amorphous region above its crystallization temperature (lower than the melting temperature) and the material returns into the crystalline state (SET). In the OUM cell this will be at the electrode-phase change material contact, whereas for the line cell this will be at the position where the current density is the highest.

In the case of RESET, electrical power has to be dissipated into the crystalline phase to melt the material. This power is delivered by the connected transistor. For optimum power transfer, the resistances of the crystalline part of the memory cell (to be amorphized) and the impedance of the transistor, need to match. In CMOS the impedance of the transistor and the peak currents are set for every technology node. This means that the resistance of the phase change cell should be scaled to the characteristics of the accompanying transistor.

An advantage of the line cell concept is that the resistance can be tuned by its geometry. Moreover, the resistivity of the material can be modified. This should be done without sacrificing endurance, retention and programming characteristics. In this paper we describe the tuning of the resistance of doped SbTe phase change materials and the properties of memory line cells.