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3-D Simulation Model of Phase Change and Percolation in Phase Change Memory[1] OZGUR BURAK ASLAN, IBRAHIM CINAR, GULSEN KOSOGLU, GULEN AKTAS, OZHAN OZATAY, Bogazici University , Department of Physics — Even though phase change memory (PCM) appears as a promising nonvolatile solid state memory with its high signal to noise ratio and superior scalability compared to other memory technologies, the complex nature of the phase change process necessitates advanced numerical modeling to optimize the performance of nanoscale memory cells. The phase change and the percolation processes of a nanoscale PCM cell during SET (turn on) and RESET (turn off) operations have been simulated based on a three dimensional finite element model. A multiphysics approach with coupled differential equations is used to observe and understand the phase change and percolation dynamics. The model to represent the PCM is divided into submodels consisting of an electrical, a thermal and a phase change model that affects nucleation kinetics of crystallites. Coupling the submodels in the framework of the multiphysics approach, this model allows us to predict threshold voltage and recrystallization temperature for switching by detecting the critical conditions for the formation of a conductive percolation path in phase change process. These results will be compared to the experimental results to be carried on. The subject of electrical and thermal model will be mentioned in another presentation.

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