Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

3-D Numerical Study of Switching Dynamics in Nanoscale Phase Change Memory Devices[1] IBRAHIM CINAR, GULSEN KOSOGLU, OZGUR BURAK ASLAN, GULEN AKTAS, OZHAN OZATAY, Bogazici University, Department of Physics — Phase change memory (PCM) is currently regarded as a strong candidate technology to replace Flash memory in the market. In this work we report a detailed numerical study of the switching process in a nanoscale PCM cell, namely its switching dynamics during SET (turn on) and RESET (turn off) operations. A comprehensive picture of the electrical, thermal and phase change dynamics is obtained using a multiphysics approach with coupled differential equations in the framework of a three dimensional finite element model. The complexity of the problem was handled by constructing separate submodels; an electrical model which involves a temperature and phase dependent electrical conductivity, a thermal model where the joule heating from the electrical current serves as the heat source and involves temperature and phase dependent thermal conductivity and a phase change model. In this presentation we will concentrate on the electrical and thermal submodels in detail. The results of the phase change model taking into account homogeneous and heterogeneous nucleation kinetics will be discussed in another presentation. We will compare the numerical results with experimental data on GST based nanoscale phase change devices with various contact sizes and shapes.

[1]This work has been supported by the European Commission FP7 Marie Curie IRG grant: PCM-256281, Bogazici University Research Fund: 6121, Turkish Academy of Sciences TUBA-GEBIP award.

Ibrahim Cinar
Bogazici University, Department of Physics

Date submitted: 11 Nov 2011 Electronic form version 1.4