Notice and Invitation

Oral Defense of Doctoral Dissertation
The Volgenau School of Engineering, George Mason University

Vasileia Georgiou
Bachelor of Science, National Technical University of Athens, 2009
Master of Science, George Mason University, 2012

Glassy – Electret Ferroelectric Random Access Memory (GeRAM)

Thursday, November, 30, 2017, 10:30 am
ENGR 2901
All are invited to attend.

Committee

Dr. Dimitrios Ioannou, Chair
Dr. Qiliang Li
Dr. Rao Mulpuri
Dr. Yuri Mishin
Dr. Kin Cheung

Abstract

Interest on ferroelectric memory devices based on polar polymers has been increasing at a rapid rate and are currently the focus of multiple studies. In these devices, the program/erase of memory involves the physical rotation of dipoles by an applied electric field. To obtain fast programming speed the operating temperature needs to be well above the polymer glass transition temperature (T_g), as at temperatures below T_g the dipoles are locked in place. However, fast programming achieved this way means the dipoles are easy to rotate, leading to a short retention time.

In this dissertation, we demonstrate a radically new ferroelectric memory device concept based on polar polymers with T_g well above operation temperature. To achieve fast programming, we momentarily elevate the local temperature to well above T_g while applying a programming electric field. At the normal operation temperature, well below T_g, the dipoles are locked in their position. Neither depolarization field nor READ operation can disturb the memory state. This dual-condition programming (temperature and electric field) with long retention time is demonstrated using a thin-film ferroelectric field effect transistors (FeFET) with LaRC - CP1 polyimide (T_g ~ 265 ^oC) as the gate dielectric (15 nm) and a doped polysilicon (15 nm) channel. Retention of the memory states with different programming conditions was studied. This new approach can lead to multi-states memory with extremely long retention times, immune to depolarization fields, while using low cost processing materials that are CMOS compatible and highly scalable.

A copy of this doctoral dissertation is on reserve at the Johnson Center Library.