



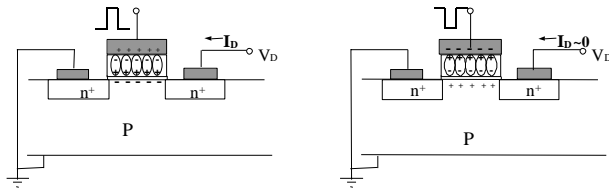
The FEDRAM: A Novel Capacitor-less DRAM Cell Based on Ferroelectrics

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Principle of Operation of FEDRAM



Programming:

$\square \rightarrow \infty(\text{FE}) \rightarrow \text{on} \rightarrow "1"$

$\square \rightarrow \infty(\text{FE}) \rightarrow \text{off} \rightarrow "0"$

Read out: (@ $V_g=0$)

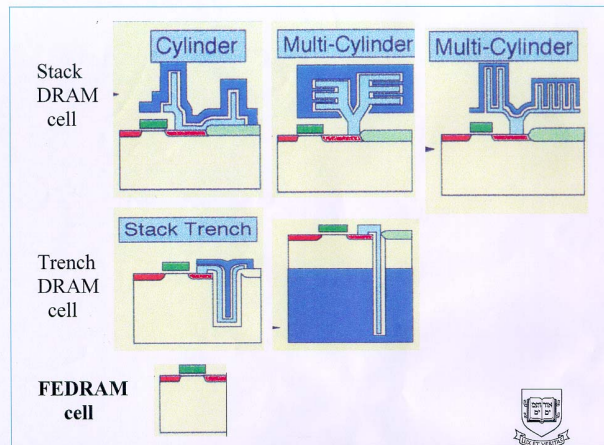
Large $I_D \rightarrow "1"$

$I_D=0 \rightarrow "0"$

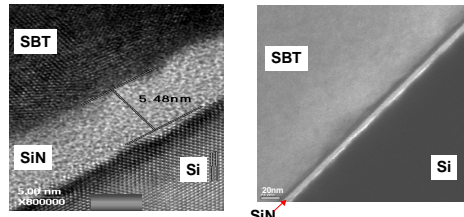
Refresh:

Like all DRAM circuits

FEDRAM Cell is Much Smaller than Conventional DRAM Cells

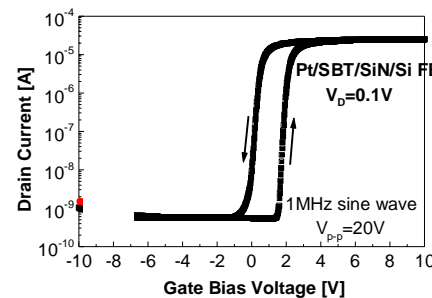
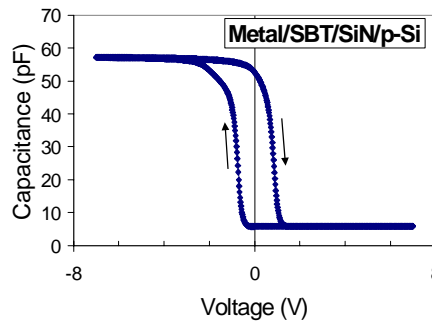


Experimental Results to Demonstrate Feasibility of FEDRAM Concept



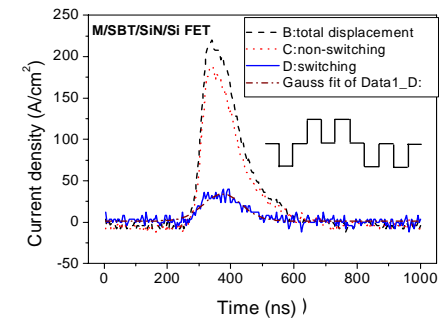
TEM Cross sectional View of SBT/SiN/Si Gate Stack of Memory Cell

SBT: $\text{SrBi}_2\text{Ta}_2\text{O}_9$ is a ferroelectric material.



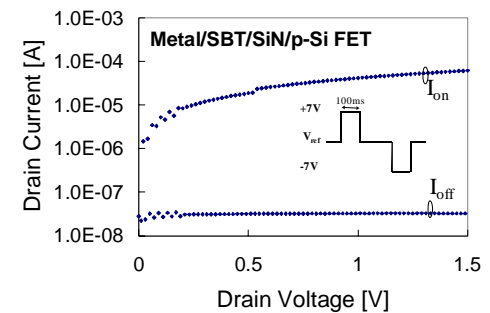
C-V (upper plate) and I-V (lower plate) curves of FEDRAM memory cell exhibit sizable memory window between two bistable states.

Switching Speed of FEDRAM



The measured switching speed for this experimental cell is around 100 ns, which will be much improved by reducing the cell size.

The "On" and "Off" Currents of the FEDRAM Cell



Several Orders of On/Off Current Ratio are Observed Over a Range of Drain Voltages.