INTERPLAY BETWEEN POLARISATION SWITCHING AND CHARGE TRAPPING IN FERROELECTRIC FIELD-EFFECT TRANSISTORS

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The discovery of ferroelectric hafnium oxide, which is compatible with semiconductor manufacturing, led to the re-emergence of ferroelectric field-effect transistors in modern microelectronics. Ferroelectric field effect transistors (FeFET) show unique properties for applications in the field of emerging memories, in-memory computing, and neuromorphic computing.
In order to improve FeFET device characteristics with respect to endurance, retention and variability for small device geometries, target programming algorithms can be developed. This requires a solid understanding of charge trapping and polarisation switching phenomena and their interplay in ferroelectric field-effect transistors. The switching, trapping and detrapping characteristics of the device and their influence on target programming algorithms are presented. A deep analysis on the charge trapping and polarisation switching characteristics is performed by designing comprehensive electrical tests and model the device using the GinestraTM multi-scale simulation platform.
Transfer characteristics of the FeFET devices are compared with the polarisation response of the ferroelectric capacitors (FeCAP) for better understanding of ferroelectric switching and retention mechanisms. By means of modelling the electrical characteristics it can be shown that charge trapping plays an essential part in the stabilisation of polarisation switching and can improve the retention behaviour.

Keywords
FeFET, Charge Trapping, Polarization Switching, Reliability.

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References
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