FERROELECTRIC TUNNELING JUNCTIONS FOR BEYOND VONNEUMANN COMPUTING

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The discovery of ferroelectricity in doped HfO_2 that was firstly published in 2011 by Böschke et al. strongly increased the interest in ferroelectricity. The polarization reversal in ferroelectric HfO_2 films can be adopted to store information in three distinct device classes. Depending on the material stack composition different devices can be constructed from the very same ferroelectric layer - ferroelectric capacitors (FeCAP), ferroelectric field effect transistors (FeFET) and ferroelectric tunnel junctions (FTJ). The electrical characteristics of these devices are strongly influenced by the whole material stack, rather than being dictated by the properties of the ferroelectric layer itself. In this talk I will focus on the design and electrical characteristics of HfO_2-based FTJ bi-layer devices. Moreover, considering the application of FTJs for beyond von-Neumann architectures, I will discuss the constraints on the circuit design that arise from the specific FTJs device properties.

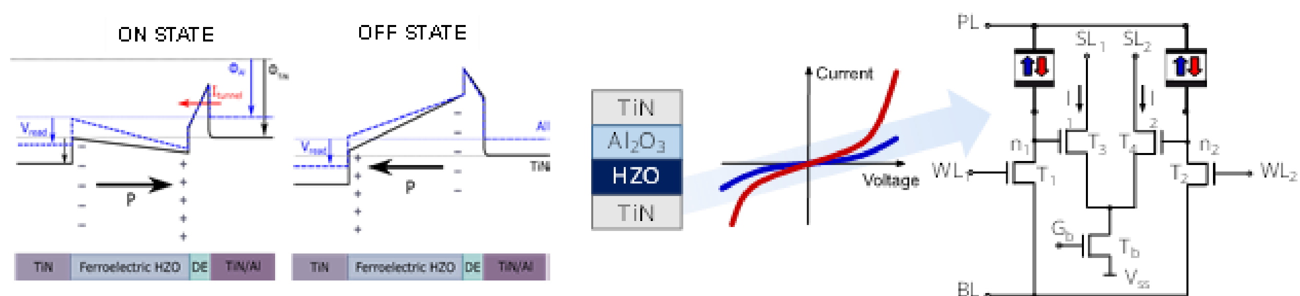

Figure 1. HZO/Al_2O_3 bi-layer Ferroelectric Tunneling Junction for adoption in differential synaptic circuit (adapted with permission from [1]. Copyright 2021 IEEE.)

Keywords
FTJ, ferroelectric HfO2.

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Reference

[1] E. Covi et al., "Ferroelectric Tunneling Junctions for Edge Computing", 2021 IEEE International Symposium on Circuits and Systems (ISCAS), IEEE (2021).