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Scalable ferroelectric MOS capacitors comprised of single crystalline SrZrxTi1-xO3 on Ge.[1] REZA MOGHADAM, UT Arlington, Z.-Y. XIAO, Univ Nebraska Lincoln, K. AHMADI-MAJLAN, UT Arlington, E. GRIMLEY, NC State University, P.V. ONG, Pacific Northwest National Laboratory, J. M. LEBEAU, NC State University, S. A. CHAMBERS, PNNL, X. HONG, Univ Nebraska Lincoln, P. SUSHKO, PNNL, J. H. NGAI, UT Arlington — The epitaxial growth of multifunctional oxides on semiconductors has opened a pathway to introduce new functionalities to semiconductor device technologies. In particular, ferroelectric materials integrated on semiconductors could lead to field-effect devices that require very little power to operate, or that possess both logic and memory functionalities. The development of metal-oxide-semiconductor (MOS) capacitors in which the polarization of a ferroelectric gate is coupled to the surface potential of a semiconducting channel is essential in order to realize such field-effect devices. Here we demonstrate that scalable, ferroelectric MOS capacitors can be realized using single crystalline SrZrxTi1-xO3 (x= 0.7) that has been epitaxially grown on Ge. Single crystalline SrZrxTi1-xO3 exhibits characteristics that are ideal for a ferroelectric gate material, namely, a type-I band offset with respect to Ge, large coercive fields and polarization that can be enhanced with electric field. The latter characteristic stems from the relaxor nature of SrZrxTi1-xO3. These properties enable MOS capacitors with 5 nm thick SrZrxTi1-xO3 layers to exhibit a nearly 2 V wide hysteretic window in the capacitance-voltage characteristics. The realization of ferroelectric MOS capacitors with technologically relevant gate thicknesses opens the pathway to practical field effect devices.

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