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Strain controlled ferroelectric switching time of $BiFeO_3$ capacitors ER-JIA GUO, ANDREAS HERKLOTZ, KATHRIN DOERR, Institute of Physics, MLU-Halle Wittenburg, Germany, MAX-PLANK INSTITUTE OF MICROSTUCTURE IN HALLE COLLABORATION — Recent advances in the epitaxial growth of complex oxide thin films made an artificial control of the strain states of ferroelectric (FE) films possible However, it is quite difficult to separate the intrinsic strain effects on FE switching from those effects resulting from the variable microstructures and defects. For this reason, the switching kinetics which is particularly sensitive to defects has not yet been investigated in controlled strain states. In this paper, we investigated the strain-dependent switching of $BiFeO_3$ capacitors grown on piezoelectric PMN-PT substrates at various temperatures. The FE switching exhibits good agreement with the KAI model. The strain-induced relative change of the switching time is different in the low and high electric field regions, showing a crossover from slowing down at low fields to acceleration of the switching at high fields under $\sim$0.1% of reversible compressive strain. We attribute this behavior to the difference between the dynamics of domain-wall propagation in the creep and depinning regimes. As the temperature decreases, a tenfold strain-induced enhancement of the switching time was observed as a result of reduced thermal activation and the strain-induced rise of the pinning potential. This work will advance the fundamental understanding of the domain switching processes. The huge sensitivity of the switching time bears a strong potential for the optimization of FE devices.

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