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In situ TEM studies of interaction between ferroelastic and ferroelastic domains during ferroelectric switching PENG GAO, CHRISTOPHER NELSON, JACOB JOKISAARI, Department of Materials Science and Engineering, University of Michigan, SEUNG-HYUB BAEK, CHUNG WUNG BARK, CHANG-BEOM EOM, Department of Materials Science and Engineering, University of WisconsinMadison, XIAOQING PAN, Department of Materials Science and Engineering, University of Michigan — Dynamic interaction between ferroelastic (90 degree) and ferroelectric (180 degree) domains in lead zirconate titanate during ferroelectric switching was investigated by in situ TEM. It was found that 90 degree domain walls were immobile under applied bias and act as obstacles to 180 degree domain wall motion. Pinning of the incident 180 degree domain wall occurs directly at the leading 90 degree domain wall and results in a charged head-to-head polarization vector configuration and thereby a large surface energy. This causes the roughening of the domain wall which was atomically sharp before switching. Subsequent switching occurs through the nucleation of a new domain on the opposite 90 degree domain wall and ultimately results in 180 degree switching across the film with the 90 degree domain wall still present. Although they were immobile, the 90 degree domains could sometimes be erased by an external electrical field parallel to the normal axis polarization and would return when the field was removed. This suggests that a pre-pulse opposite to the desired writing direction which momentarily erases these domains may improve switching efficiency.

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