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Highly Tunable Ferroelectricity in Hybrid Improper Ferroelectric $Sr_3Sn_2O_7$[1] XIANGHAN XU, YAZHONG WANG, FEI-TING HUANG, KAI DU, Rutgers University, ELIZABETH NOWADNICK, UC Merced, SANG-WOOK CHEONG, Rutgers University — The theoretical and experimental success in hybrid improper ferroelectricity (HIF) shed light on a novel way to couple polarization with other physical properties. However, switching the polarization efficiently still remains highly challenging, mainly due to the large energy barrier of oxygen cage movements and pinning/leakage from grain boundaries. Here, we show that the high-quality $Sr_3Sn_2O_7$ single crystal exhibits the smallest coercive field among all explored HIFs. Remarkably, the 90^o polarization domains can be easily created/erased by a tiny stress at room temperature. In addition, abundant charged domain walls are observed in both pristine and new-created regions. Consistently, DFT calculation indicates a 90^o intermediate step with a small energy barrier in between 180^o polarization switching. Our observations open up several important directions for future exploration– such as charged domain walls manipulated by stress and the possibility of fast-writable-erasable ferroelectric memorial devices by electrical/mechanical excitations.

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