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Large Relaxation (Polar distortion) of $SrTiO_3$ interfaced with $La_{2/3}Sr_{1/3}MnO_3$[1] ZHEN WANG, HANGWEN GUO, LINA CHEN, MOHAMMAD SAGHAYEZHIAN, E.W. PLUMMER, JIANDI ZHANG, Louisiana State Univ - Baton Rouge, JING TAO, LIJUN WU, HUOLIN XIN, YIMEI ZHU, Brookhaven National Laboratory — The physics of thickness-induced metal-insulating transition in metallic oxide thin films is very interesting. The question is the behavior intrinsic or extrinsic. We explore the origin of such transition by manipulating the thickness of $La_{2/3}Sr_{1/3}MnO_3$ (LSMO) thin film grown on $SrTiO_3$ (STO) substrate and detailed property measurements and structural characterization. We observed an unexpected structural relaxation in STO when interfaced with $La_{2/3}Sr_{1/3}MnO_3$ (LSMO) by using scanning transmission electron microscopy (STEM). A large out-of-plane polar distortion of STO extends up to $8 \sim 10$ unit cell (u.c.) across the interface with the 4 u.c. insulating LSMO film, while only very moderate relaxation were found with thicker and metallic LSMO films. The electron energy loss spectrum (EELS) studies reveal that the charge transfer across the interface is similar in the both films. The nature of such an overlayer-dependent structural relaxation will be discussed: Is this thickness dependent relaxation of the STO an inherent property of metallic/insulating properties of the ultrathin film?

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Zhen Wang
Louisiana State Univ - Baton Rouge

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