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Local Raman spectroscopic study of $BiFeO_3$ strained states YEN-CHIN HUANG, YI-CHUN CHEN, FENG-NAN CHU, Department of Physics, National Cheng Kung University, WEN-I LIANG, HSIANG-JUNG CHEN, YING-HAO CHU, Department of Materials Science and Engineering, National Chiao Tung University — Among single-phase multiferroic materials, $BiFeO_3$ (BFO) has relatively high Curie and N$'$eel temperatures, which possesses ferroelectric and antiferromagnetic couplings at room temperature, so is motivated for novel device applications. Recent studies had shown piezoelectric and magnetic properties of BFO in strained states varied significantly. For BFO epitaxial films grown on $LaAlO_3$ substrate, high piezoelectric coefficient and spontaneous ferromagnetic moments had been demonstrated in a new kind of morphotropic tetragonal-rhombohedral phase boundary driven by substrate strain. In this study, we used Raman spectrum to investigate the local BFO distorted structure under substrate strain or strain caused by external electric fields. The crystal structure of BFO under compressive substrate strain is monoclinically distorted. The ordering of the monoclinic structures could also be controlled by electric field. These two kinds of strained states were locally studied by atomic force microscopy (AFM) equipped with on-axis Raman measurement. This study provided the basic physical insight of unique physical properties depended on distorted structures.

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