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Conduction mechanism in $BiFeO_3$-$CoFe_2O_4$ columnar nanostructure YI-CHUN CHEN, Department of Physics, National Cheng Kung University, YING-HUI HEISH, CHEN-WEI LIANG, Department of Materials Science and Engineering, National Chiao Tung University, JIA-MING LIOU, Department of Physics, National Cheng Kung University, YA-PING CHIU, Department of Physics, National Sun Yat-Sen University, QING HE, Advanced Light Source, Lawrence Berkeley National Laboratory, QIAN ZHAN, Department of Materials Physics and Chemistry, University of Science and Technology Beijing, YING-HAO CHU, Department of Materials Science and Engineering, National Chiao Tung University — Multiferroic materials, which possess interaction between more than one ferroic ordering parameters, had attracted great scientific and technological interests. Among the biphase magneto-electric nanostructures, $BiFeO_3$-$CoFe_2O_4$ (BFO-CFO) is a model system with ferroelectricity and ferrimagnetism coupling to each other through stress mediation. In this study, we investigated the electron transport behavior and the leakage-current mechanism in high quality nano-composite BFO-CFO thin films. The CFO nanopillars were heteroepitaxially embedded in a BFO matrix grown on $SrTiO_3$ substrates. Macroscopic vertical transport result showed the interface limit model was the dominant mechanism of the large leakage. Local conduction in epitaxial BFO-CFO nanostructures was studied by conducting atomic force microscope (C-AFM) while the nature of band structure variation was demonstrated by scanning tunneling microscope (STM). This study provides a basic explanation of leakage mechanism in self-assembled composite material system.

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