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Strain Engineering in Self-Assembled Vertically Aligned Nanocomposite Thin Films ZHENXING BI, MPA-CINT, MS K771, Los Alamos National Laboratory, NM 87545, USA, AIPING CHEN, Texas A&M University, SOPHIE HARRINGTON, University of Cambridge, HAIYAN WANG, Texas A&M University, JUDITH DRISCOLL, University of Cambridge, QUANXI JIA, MPA-CINT, MS K771, Los Alamos National Laboratory — Self-assembled vertically aligned nanocomposite (VAN) thin films hold great promises in engineering material functionalities including ferroelectric, ferromagnetic, and multiferroics by tunable intrinsic strains. The VAN exhibits a well ordered vertically columnar structure with highly epitaxial quality in thin film. In this work, we describe the approach of strain tuning in $(BiFeO_3)_x$:$(Sm_2O_3)_{1-x}$, $(La_{0.7}Sr_{0.3}MnO_3)_{0.7}$:$(Mn_3O_4)_{0.3}$ and $(BaTiO_3)_x$:$(Sm_2O_3)_{1-x}$ VAN thin films grown by pulsed laser deposition (PLD). We investigate the intrinsic strain mechanism in VAN thin films as well as the effects of film growth kinetics and thermodynamic stability to the final VAN architecture. We also demonstrate the tunable "microstructure - strain - physical properties" relationships in VAN thin films. Experiment results reveal that: 1) Enhanced vertical strain can cause systematic reduction of dielectric loss of VAN thin films; 2) Strain tuning in ferromagnetic VAN thin films can lead to tunable T_c and magneto resistance; and 3) RT ferroelectric can be achieved by strain tuning of BTO and results the highest T_c in VAN thin film. Furthermore, geometrically controlled nanoporous structure can also be processed by thermal treatment on VAN thin films.

Zhenxing Bi
Center for Integrated Nanotechnologies, MS K771,
Los Alamos National Laboratory, NM 87545, USA

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