

Coherent Growth of α -Fe₂O₃ in Ti and Nd Co-doped BiFeO₃ Thin Films

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Coherent dendritic α -Fe₂O₃ precipitates were observed to form at the surface of epitaxial films of (Bi_{0.75}Nd_{0.25})(Fe_{0.97}Ti_{0.03})O₃ (BNFO) grown by pulsed laser deposition. The Fe₂O₃ dendrites are assemblages of nanosized particles with an approximate length of 500 nm. Through the use of atomic resolution scanning transmission electron microscopy, a transition zone at the BNFO/ α -Fe₂O₃ interface, \sim 2 unit-cells wide, was observed to be Fe₂O₃-rich with the perovskite structure. It is proposed that the formation of the Fe₂O₃-rich perovskite structure encourages epitaxial growth of the α -Fe₂O₃ rather than the formation of the incoherent Fe₂O₃ particulate second phase frequently reported in BiFeO₃-based thin films.

Impact Statement The discovery of the new structure may explain the abnormally high ferromagnetic response observed in the BiFeO₃-based single-phase epitaxial films, and will benefit the communities of materials science.

