

Nano Crystalline Ferroelectric BiFeO₃ Thin Films by Low-temperature Atomic Layer Deposition

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In this work, ferroelectricity is identified in nanocrystalline BiFeO₃ (BFO) thin films prepared by low-temperature atomic layer deposition. A combination of X-ray diffraction, reflection high energy electron diffraction, and scanning transmission electron microscopy analysis indicates that the as-deposited films (250 °C) consist of BFO nanocrystals embedded in an amorphous matrix. Postannealing at 650 °C for 60 min converts the sample to a crystalline film on a SrTiO₃ substrate. Piezoelectric force microscopy demonstrates the existence of ferroelectricity in both as-deposited and postannealed films. The ferroelectric behavior in the as-deposited stage is attributed to the presence of nanocrystals. Finally, a band gap of 2.7 eV was measured by spectroscopic ellipsometry. This study opens broad possibilities toward ferroelectric oxides on 3D substrates and also for the development of new ferroelectric perovskites prepared at low temperature.

