

The reverse of triaxial strain fields in a multiferroic BiFeO₃ thin film as studied using scanning x-ray microdiffraction

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ABSTRACT

The dramatically enhanced polarizations and saturation magnetizations observed in the epitaxially constrained BiFeO₃ (BFO) thin films with their pronounced grain-orientation dependence have attracted much attention and are attributed largely to the constrained in-plane strain. Thus, it is highly desirable to directly obtain information on the two-dimensional (2D) distribution of the in-plane strain and its correlation with the grain orientation of each corresponding micro-region. Here we report a 2D quantitative mapping of the grain orientation and the local triaxial strain-field in a 250nm-thick multiferroic BFO film using a synchrotron x-ray microdiffraction technique. This direct scanning measurement demonstrates that the deviatoric component of the in-plane strain tensor is between 5×10^{-3} and 6×10^{-3} and that the local triaxial strain is fairly well correlated with the grain orientation in that particular region at room temperature. We have performed a 2D quantitative mapping of the grain orientation and the local triaxial strain-field in a BiFeO₃ thin film at room temperature, 373K, 673K by using a synchrotron X-ray microdiffraction technique. This direct scanning measurement demonstrates that the deviatoric component of the in-plane strain tensor is reversed with temperature raising, and that the local triaxial strain is fairly well correlated with the grain orientation in that particular region.

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