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Grating-patterned $\text{Bi}_{0.85}\text{La}_{0.15}\text{Fe}_{0.95}\text{Mn}_{0.05}\text{O}_3$ epitaxial thin film prepared using photosensitive sol-gel method and its ferromagnetic and ferroelectric properties

Fuxue Yan, Kai Han, Zhichao Jiao, Gaoyang Zhao, Ting Wang, Menglong Guo, Yuanqing Chen

School of Materials Science and Engineering, Xi'an University of Technology, Xi'an 710048, P.R. China

Abstract: $\text{Bi}_{0.85}\text{La}_{0.15}\text{Fe}_{0.95}\text{Mn}_{0.05}\text{O}_3$ (BLFMO) gel films with benzoylacetone (BzAc) as a chelating reagent were fabricated on (00 l) LaAlO_3 (LAO) substrates using a photosensitive sol-gel method. The morphology, crystalline structure, electric and magnetic properties, and the grating-pattern of the films were investigated. The results showed that the epitaxial BLFMO films deposited on LAO single crystal substrates exhibit a higher degree of the c -axis orientation. The remnant polarization and saturation magnetization were found to be higher than those of the randomly oriented BLFMO films. Moreover, the gratings of the film with a period of 1 μm were obtained after exposure to two interference laser beams followed by leaching in ethanol. After treatment at 600°C, the gel film turned into inorganic film gratings.

Keywords: C -axis oriented films; Laser interference; Magnetoelectric films; Saturation magnetization; Remnant polarization.

1. Introduction

BiFeO_3 (BFO), a rhombohedrally distorted perovskite-structured material with $R3c$ space group, possessing ferroelectric order ($T_c \approx 1103\text{K}$) and G-type anti-ferromagnetic order ($T_N \approx 643\text{K}$), is known to be the only single-phase material that shows multiferroic properties at room temperature. It attracted a great interest due to potential applications in the fields of electronics, spin valves, transducers, multiple state memory devices, and microelectromechanical systems [1-5]. The key issue towards applications is the preparation of BFO with high quality resulting in good

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