

Magnetic and Dielectric Properties of Chemically Synthesized $\text{Co}_{3-X}\text{Mn}_X\text{O}_4$ (111)-Textured Films

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【Introduction】 In recent years, considerably attention has been drawn to multiferroic materials because of the possibility of modulating electrical properties using magnetic fields and vice versa. $\text{Co}_{3-X}\text{Mn}_X\text{O}_4$ (CMO) is a multiferroic material and is known to be ferrimagnetic below $\sim 170\text{ K}^{[1]}$ and ferroelectric blow $\sim 325\text{ K}^{[2]}$ when $X = 0.9$. One of the simplest methods to synthesize CMO is sol-gel method. Thus, a number of CMO films were synthesized by sol-gel method in order to investigate its properties.^[3] In sol-gel method, however, it is difficult to control the texture of CMO films. Since both ferrimagnetic and ferroelectric properties have crystalline anisotropy, the texture of samples is really important. There are needs of technique to control the texture of film samples synthesized by sol-gel method. In this study, we are presenting synthesis of (111)-textured CMO films on (100) Si substrates by spin coating and its magnetic and dielectric properties.

【Experimental】 CMO films were synthesized using precursor synthesized by co-precipitation. The precursor synthesized by co-precipitation that was adjusted the amounts of Co^{2+} and Mn^{2+} exactly to the targeted molar ratio was stored in dark place for 2 days at 303 K. Subsequently, the precursor was dissolved into ethanol and was spin-coated onto (100) Si substrates 20 times using pipette. Then, the substrates were dried and crystalized by annealing at 1073 K for 3 hours. Spin coating was repeatedly carried out to each film 4 times after annealing and the crystal structure of each film was characterized by XRD.

【Results and Discussion】 The crystal structure of CMO ($X = 0.0\sim 0.8$) is observed by XRD (Fig.1). In order to evaluate degree of texture, Lotgering Factor (LF) is used. The LF of $X = 0.0, 0.2, 0.4, 0.6$ and 0.8 , is 0.78, 0.87, 0.71, 0.67 and 0.72, respectively. Although there are some difference between LF, indeed we have confirmed that the CMO films are textured in $\langle 111 \rangle$ direction. The magnetic and dielectric properties of the (111)-textured CMO films will be shown in the presentation.

【References】 [1] P.L. Meena, et al., *J. Mag. Mag. Mater.* **403**, 193 (2016). [2] P. L. Meena, et al., *J. Appl. Phys.* **106**, 027105 (2009). [3] H. Brodeneuve, et al, *J. Solid State Chem.* **182**, 396 (2009).

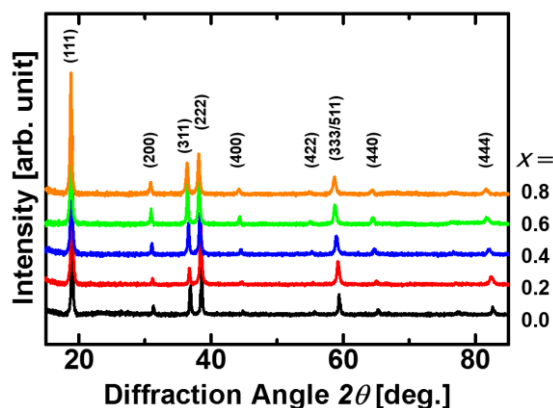


Fig.1 XRD spectra for the CMO films.