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A study on magnetocapacitor for magnetic and dielectric multilayer thin films

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Capacitors based on ferroelectric perovskites are potentially attractive for applications in nanoscience [1]. And it becomes possible to fabricate magnetocapacitor by artificially making ferroelectrics and ferromagnets in nanoscale multi-layer thin films [2]. It involves the coupling between ferroelectricity and magnetism through interface bonding. In this study, we are focused on a possibility of enhanced capacitance and a necessary of studies for magnetocapacitor to overcome a control of only charge and spin by electric and magnetic field, respectively. To fabricate magnetocapacitor, multilayer thin films were deposited on Pt (111) substrates for CoNiFe (CNF) and BaTiO$_3$ (BTO) by using pulse laser deposition (PLD) system. Fabricated thin films of three structures with BTO, BTO/CNF and CNF/BTO/CNF were studied for various properties of crystal, microstructure, magnetic properties and electric properties by using X-ray diffraction (XRD), atomic force microscope (AFM), vibrating sample magnetometer (VSM) and Aglient 4284A LCR meter, respectively. Capacitance of CNF/BTO/CNF multilayer thin film enhanced as being near tetragonal structure with increasing of c/a ratio because BTO combined with CNF material of lattice constant was smaller than BTO. Finally, we showed enhanced capacitances of CNF/BTO/CNF multilayer thin film by magnetic field for emergence of magnetocapacitance effect as shown in Fig. 1.

![Fig. 1 C-V curves of CoNiFe/BaTiO$_3$/CoNiFe thin films by magnetic field](image)

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