Self-aligned β-phase conformation and self-biased magnetoelectric voltages in tri-layer laminates of PVDF/$CoFe_2O_4$/Ni

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Recently, since the demand for useful applications that can be used in daily life such as wearable device, self-diagnosis kits, and smart health monitoring systems increases, polymer-based magnetoelectric (ME) films have been actively studied. Poly(vinylidene fluoride) (PVDF), which is representative piezoelectric polymers, has been widely used for ME devices because of their configuration of electrically asymmetric β-phase. However, there is a critical problem that poling process was needed to have one-direction alignment of the β-phase which can generate ME responses.
In this study, PVDF/Cobalt ferrite ($CoFe_2O_4$)/Nickel (Ni) ME films were prepared by sol-gel coating and doctor blading. First, to get self-aligned β-phase and self-biased ME effect, $CoFe_2O_4$/Ni films were prepared by sol-gel and calcination of $CoFe_2O_4$ layers on the Ni. Then, PVDF films were cast by doctor blading under various conditions such as concentration, drying temperature, and casting height on the $CoFe_2O_4$/Ni films. Finally, PVDF/$CoFe_2O_4$/Ni ME films were found to obviously exhibit self-bias ME voltages without further poling process.