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Strong sub-resonance magnetoelectric coupling in PZT-$NiFe_2O_4$-PZT thin film composite

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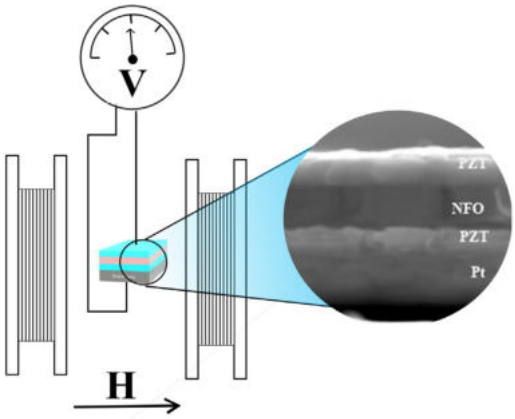
GRAPHICAL ABSTRACT



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ABSTRACT

Magnetoelectric composite thin films of 2–2 type attract significant attention due to potentially high magnetoelectric (ME) coupling and ease of miniaturization. $PbZr_{0.52}Ti_{0.48}O_3$ (PZT) and $NiFe_2O_4$ (NFO) have been among the materials of interest for the development of such composites, however, the obtained values of ME coefficients were sufficiently low so far. Also, these works report ME coupling in micrometer thick composite films. Here, we report strong magnetoelectric coupling (maximum longitudinal ME coefficient ≈ 1.2 V/cm·Oe at 100 kHz) obtained in nanograined PZT-NFO-PZT thin films of nanometer thickness fabricated on $Si/SiO_2/Ti/Pt$ substrates by sol–gel spin coating technique. This is a strong magnetoelectric coupling recorded in thin film composites involving ferrites at sub-resonant conditions and can be used in miniature transducers and sensors and for data processing devices.

1. Introduction

Multiferroic materials which display both ferroelectric and ferro/ferrimagnetic characteristics are currently hot topic of research owing to their tremendous application potential in novel

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