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15-mode piezoelectric composite and its application in a magnetoelectric laminate structure

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Abstract

Magnetoelectric composites have recently been attracting attention owing to their possible application in various advanced electronics. The piezoelectric material used in a magnetoelectric composite is an important determinant of the electrical performance of the device. In this study, we report on the fundamental characteristics and magnetoelectric application of a 15-mode piezoelectric composite. The centimeter-scale 15-mode piezoelectric composite implemented by a novel fabrication process exhibits successful 15-mode operation along with excellent piezoelectric properties $d_{15} = 793 \times 10^{-12} \text{ C N}^{-1}$, $g_{15} = 32 \times 10^{-3} \text{ V m N}^{-1}$, $k_{15} = 0.62$, and $d_{15} \cdot g_{15} = 25376 \times 10^{-15} \text{ m}^2 \text{ N}^{-1}$. Magnetostrictive-piezoelectric laminate structures designed to generate shear stress were fabricated using the 15-mode piezoelectric composites, and their magnetoelectric characteristics were investigated systematically. A giant magnetoelectric voltage coefficient of $18.4 \text{ V cm}^{-1} \text{ Oe}^{-1}$ was obtained at a low frequency of 660 Hz from the laminate, indicating the potential of the 15-mode

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