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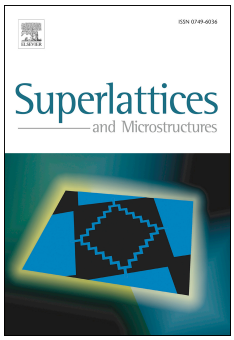

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Propagation study of Rayleigh surface acoustic wave in a one-dimensional piezoelectric phononic crystal covered with two homogeneous layers

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ABSTRACT

In this paper, plane wave expansion and stiffness matrix methods are adopted to analyze the dispersion relation of Rayleigh surface acoustic waves in a piezoelectric phononic composite composed of two homogeneous layers (ZnO and AlN) deposited on a one-dimensional piezoelectric (111) Si/AlN phononic substrate. The effect of crystallographic orientation of silicon on the dispersion relation is discussed. We found that the width of the gap became larger when the middle layer was introduced. The influence of filling fraction, thicknesses of the film and the middle layer on the band gap width is discussed. In addition, the phase velocity and the electromechanical coupling coefficient for Rayleigh surface modes are calculated versus the filling fraction. A comparison of phononic composite with ZnO/ AlN/ (111)Si layered structure is presented to deduce the interest of introduction of the phononic substrate.

Keywords: Piezoelectric phononic composite; Layered structure; Dispersion relation; Surface acoustic wave; Band gap; PWE method; Stiffness matrix method