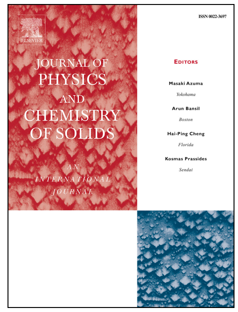
Accepted Manuscript



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PII: S0022-3697(18)30418-9

DOI: 10.1016/j.jpcs.2018.08.012

Reference: PCS 8688

To appear in: *Journal of Physics and Chemistry of Solids*

Received Date: 18 February 2018

Revised Date: 9 August 2018

Accepted Date: 10 August 2018

Mechanism for controlling the band gap and the flat band in three-component phononic crystals

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Abstract: New expressions of equivalent stiffness and equivalent mass are proposed to study the mechanism for the formation of the band gap in cylindrical three-component phononic crystals. The vibration modes are classified into three classes: transverse, longitudinal, and torsional modes. For each mode, the new expressions for the equivalent stiffnesses and equivalent masses of the spring-mass system are deduced, and these can be used to investigate the key factors for the determination of the band gap in the designed three-component phononic crystal. The results indicate that the flat band is a special feature of the designed cylindrical three-component phononic crystal. Equivalent inertia is the key factor for the determination of the flat band and the band gap in this three-component phononic crystal.

Keywords: Phononic crystal, Band gap, Local resonance, Analytical method

1. Introduction

Similar to a photonic crystal [1-4], a phononic crystal is a composite material that has attracted considerable interest and attention because of its excellent performance in controlling elastic waves [5-12]. The existence of band gaps in phononic crystals can be used for sound insulation and environmental noise control [13-18]. The band gaps

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