PHONONIC BAND GAPS IN AL2O3/EPOXY COMPOSITE

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During the last few decades many researches have been interested in the field of wave propagation in periodic or random composite systems. The spatially periodic composites – phononic crystals – are materials which are designed to have exotic behavior and this concept has been first conceived for photonic crystals. They have heterogeneous inclusions with periodic distribution. Due to its periodic structure, some frequency ranges may exist where elastic waves are forbidden to propagate (band gaps). In this study we have investigated theoretically the dispersion relation (band structure) of mechanical waves propagating in an inhomogeneous elastic medium reinforced by Al2O3 inclusions in a square and hexagonal lattice. We also studied the influence of the inclusion geometry. The plane wave expansion (PWE) method and the improved PWE method are used to solve the wave equation considering in-plane and transverse vibrations. The complete band gaps are observed to all geometries considered. Our findings show that the band gap width depends on the thickness of hollow inclusion. We suggest that the Al2O3/epoxy composite is feasible for mechanical vibrations management.