ACOUSTICS2008/2021 review of phononic crystals, nonlinear processes, devices and prospects

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The review of current state of the art of bulk and surface linear and non-linear acoustic wave propagation in phononic crystals (PhC) is given. First, theoretical analysis of bulk acoustic waves propagation in 2D phononic crystals composed of elastic medium with periodic systems of air holes with different symmetry is considered. The properties of hypersonic bulk and surface acoustic waves (Love, Lamb) in PhC are considered theoretically and expermentally. We studied bulk waves propagation in microstructured optical fiber preforms made of quartz. The study of simultaneous propagation of acoustic waves and light in structures being both photonic and phononic crystals was done. We study also properties of guided waves (Lamb modes) propagating in layered structures containing the magnetic films with two-dimensional periodic structures. In these structures we discovered a strong coupling between elastic and magnetic properties leading to effective waves transformation between magnetic and elastic systems. Such structures are so called magnonic-phononic crystals. The recommendations of use such unusual BAW and SAW properties in PhC for development of solid state devices are given. This work is supported by RFBR grant 08-02-00785.