ACOUSTICS2008/3159
Surface acoustic waves propagating on microstructured phononic crystals

Dieter Profunser[a], Oliver Wright[a], Osamu Matsuda[a], Yukihiro Tanaka[a], Abdelkrim Khelif[b], Vincent Laude[b] and Sarah Benchabane[b]

[a]Division of Applied Physics, Graduate School of Engineering, Hokkaido University, 060 8628 Sapporo, Japan

[b]Institut FEMTO-ST/CNRS, 32 avenue de l'Observatoire, 25044 Besançon cedex, France

We investigate the interaction between high frequency surface acoustic waves and periodic microstructured patterns that form phononic crystals. The experimental method combines an optical pump-probe setup with interferometric detection and provides picosecond temporal and micron spatial resolutions. Surface acoustic waves with frequency components up to 1.3 GHz are imaged in real-time propagating over the periodic metamaterial. We used a DRIE (deep reactive ion etching) process to fabricate 2D air-silicon phononic crystals in the form of a square lattice. We present real-time animations of surface acoustic waves scattered by the phononic crystals. In particular we describe the frequency and angular dependence of the surface acoustic wave reflection from a 2D phononic crystal boundary. Fourier analysis allows us to reveal details of the acoustic band structure including gaps. The presence of such phononic band gaps enables us to visualize surface acoustic waves in waveguides, cavities and other phononic circuits at GHz frequencies.