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A Transient Grating approach to elastic wave and thermal propagation in a 2D free-standing micrometric phononic crystal

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We investigate the phonon propagation in a 2D phononic crystal (with typical dimensions on the micrometric scale) by means of a transient grating (TG) heterodyne detected experiment. In a TG experiment both a temperature and a density grating are induced by means of optical techniques. The relaxation dynamics of the induced grating are then monitored live-time over 6 temporal decades with a probe beam. Our sample is a freestanding 100 micrometer thick polymer matrix with empty rods (filled with gas) arranged in a triangular lattice. Evidence of the presence of two different bulk wave acoustic modes are experimentally found. The excited acoustic modes show a correlation with the orientation of the sample with respect to the induced grating wave vector, while the thermal properties show a significant dependence on the magnitude of the induced grating wave vector.