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Acoustic phenomena in porous media studied by transient grating spectroscopy: a critical test of the Biot theory

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The propagation of sound in a porous solid filled by a liquid can be described by a phenomenological model introduced by M. A. Biot, that is still extensively used to predict the essential acoustic properties of a wide variety of porous media. Nevertheless testing of the Biot theory at ultra/hypersonic frequencies and in porous media with nanometric scale heterogeneities remains an open issue. We studied the propagation of acoustic waves in two liquid-filled porous glasses by heterodyne detected transient grating experiments [1]. A test of the Biot theory is presented under two new regimes, namely, for a new frequency range up to 1.3 GHz and for porous media with nanometric scale heterogeneities [2]. We show that the Biot theory describes the sound velocity data correctly, but does not account for the acoustic attenuation. We suggest that the acoustic damping is mainly due to the dissipation mechanisms intrinsic of the matrix and the liquid which are not accounted for in the theory.

[1] Time-resolved spectroscopy of complex liquids, edited by Torre R. (Springer, New York) 2008. [2] A. Taschin, R. Cucini, P. Bartolini, R. Torre, *Europhys. Lett.* In press.