Perfect and broadband acoustic absorption by metasurfaces made of aerogel clamped plates

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Silica aerogels are nanoporous lightweight materials the frame of which consists of an assembly of connected small cross-sections beam-like elements resulting from fused nanoparticles. This particular assembly additionally provides silica aerogel a very low elastic stiffness when compared to rigid silica structure of identical porosity. Therefore, when aerogel plates are clamped, they are excellent candidates to design acoustic metamaterials, because they exhibit subwavelength resonances and present efficient absorption capabilities. In this work we will study an acoustic metasurface made of metaatoms combining silica aerogel clamped plates (considered as a punctual resonators) and impedance cavities to obtain perfect absorption in a broadband frequency range. The results obtained show a good agreement between the analytical results and those obtained with the numerical simulations. The absorptive properties of the designed metaatoms are encouraging and can be applied to design more complex metasurfaces for the broadband absorption of sound.

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