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Inversion of the bulk viscosity in nonequilibrium media with heat release and new acoustical properties of such media

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New acoustical properties, which are caused by the inversion of the bulk (second) viscosity in nonequilibrium media, are investigated. Negative bulk viscosity can take place due to the positive feedback between the sound perturbation and the nonequilibrium heat release. During previous years, the conditions for the negative bulk viscosity existence were found in a large number of nonequilibrium media such as a vibrationally excited gas with stationary nonequilibrium, nonisothermal plasma, chemical active mixtures with irreversible reactions, media with nonequilibrium phases, upper atmosphere layers, and earth magma with bubbles. The following phenomena are discussed for gaseous media with negative viscosity: (1) New dispersion characteristics (in particular, the low-frequency sound speed can exceed the high-frequency one); (2) Acoustically instability of nonequilibrium media, nonlinear mechanisms of the wave growth stabilization and stationary self-sustaining structures; (3) Linear and non-linear sound beam refraction including the self-focusing (due to two self-action mechanisms in acoustically active media: the gas cooling by sound and the excitation of acoustical streaming in direction opposite to sound propagation) and the anomalous reflection (with reflection coefficient R>1) on a boundary between equilibrium and nonequilibrium media; (4) The vortex and thermal wave amplification due to intensive parametric interactions in acoustically active media.