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Efficiency enhancement in encapsulated thermoacoustic projector based on carbon nanotubes ALI ALIEV, Alan G. MacDiarmid NanoTech Institute, University of Texas at Dallas, Richardson, TX, 75083, USA, YURI GARTSTEIN, Department of Physics, University of Texas at Dallas, Richardson, TX, 75083, RAY BAUGHMAN, Alan G. MacDiarmid NanoTech Institute, University of Texas at Dallas, Richardson, TX, 75083, USA — Carbon nanotubes (CNT) can generate sound by means of thermoacoustics over a wide frequency range (1-10^5 Hz). However, the low sound generation efficiency of open CNT films at low frequencies ($\eta \propto f^2$), where the demands for large size and flexible sound projectors is high, is frustrating. The nanoscale thickness of CNT film, high sensitivity to the environment and high surface temperatures required for TA sound generation are another drawbacks suggesting an efficient protection of free-standing CNTs, demonstrated in this work by means of encapsulation in inert gases. We analyze the effect of different thermodynamic regimes on fundamental efficiency of thermoacoustics sound generation for closed system using first principle calculation and experimental investigation of encapsulated sound projector's performance. The observed sound pressure level for argon gas encapsulated transducers Q times higher than for open system, where Q is a resonant quality factor of thin vibrating plates. Moreover, the sound generation efficiency for encapsulated system is increased toward low frequencies ($\eta \propto 1/f^2$). The acoustical and geometrical parameters of resonant system for further increase of efficiency and transduction performance are discussed.

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