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Temperature and stress fields produced by ultrasound-induced cavitation in a viscoelastic medium LAUREN MANCIA, ERIC JOHNSEN, Univ of Michigan - Ann Arbor — Ultrasound contrast agents can act as cavitation nuclei that mechanically damage surrounding tissue when they oscillate in diagnostic ultrasound. Encapsulated microbubbles have also been proposed as a means to improve the efficiency and efficacy of therapeutic ultrasound by increasing the rate of tissue heating. However, the thermal and mechanical effects of cavitation are difficult to distinguish from each other and to quantify experimentally as they often occur simultaneously. To address this challenge, we study the cavitation-induced temperature and stress fields produced by a spherical bubble oscillating in a Kelvin-Voigt viscoelastic medium with nonlinear elasticity using a model that also accounts for energy transport inside and outside the bubble. We find that the primary contribution to heating is viscous dissipation, which itself depends on both the material (viscosity) and the bubble dynamics. We examine the rate of viscous heating and the magnitude of stresses over a relevant range of tissue properties and waveform parameters to determine regimes where heating is expected to be dominant. A means of estimating the expected significance of viscous dissipation from given tissue properties and waveform parameters is proposed.

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