ACOUSTICS2008/3278
Optical measurements of the hot spot and incandescent shock from high pressure cavitation in water

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Spontaneous acoustic cavitation in water at static pressure up to 300 bar has been experimentally investigated. Cavities are initiated by negative pressure and then collapse due to both acoustic pressure and shock waves reflected from the inner surface of the spherical resonator. The implosions result in intense (Mbar) shock waves and bright (1 nJ) light flashes which last from 5 to 40 nanoseconds. The optical spectrum of the flash is measured with a grating monochromator and intensified array detector for high wavelength resolution ($\sim$5 nm) but slow time resolution, and with a multiple-anode microchannel plate photomultiplier tube along with bandpass filters for fast time resolution ($\sim$1 ns) but poor wavelength resolution. The spectrum is generally broad-band and featureless, matching roughly to a Planck spectrum at 5000 to 8000K. The spectral and temporal structure of the flashes is matched to hydrocode simulations. The model suggest the flashes are due to a shell of hot, opaque, shocked water which surrounds and obscures the central hot core. (SMDC contract W9113M-07-C-0178)