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Characterization of the Dynamics of Vapor Bubble Collapse¹ RAUNAK BARDIA, MARIO TRUJILLO, Univ of Wisconsin, Madison — A numerical/theoretical analysis is presented to characterize the dynamics of a spherical vapor bubble, collapsing at different degrees of severity, controlled and quantified by the nondimensional number, B (introduced by Florschuetz and Chao, 1965). The numerical framework is exercised and validated over the three regimes of bubble collapse, namely, thermal, intermediate, and inertial collapse in increasing order of B. The conventional Rayleigh-Plesset perspective used to discriminate between different regimes, is extended to include the bubble energy balance and jump conditions. It is discovered that the time history of vapor velocity more clearly illustrates the distinctions between the three regimes. For thermal collapse, vapor velocity suffers an initial transient and then equilibrates to nearly zero. At intermediate rates of collapse, the time scales of the process are such that an imbalance occurs between the condensation rate and interface regression rate, which results in a significant magnitude of vapor velocity. At even larger rates of collapse, the time scales become exceedingly small such that the thermal boundary layer is sufficiently thin to provide the necessary heat conduction to balance the large condensation rate. resulting in negligible vapor velocity.

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