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Bubble oscillation regimes including phase change LUCA BERGAMASCO, DANIEL FUSTER, CNRS - UPMC Institut d'Alembert - Paris (France) — In this work we study thermal and mass diffusion effects on spherical bubble dynamics. The transfer function, which relates the bubble radius oscillation with pressure changes, is obtained by solving analytically the linearized form of the conservation equations inside, outside the bubble and at the interface with the surrounding fluid. Phase diagrams are then built using this transfer function, which is shown to depend on: the bubble and liquid Peclet number, the water-vapor/gas content, the Sherwood number, a dimensionless enthalpy of vaporization and the ratio of thermal conductivities between the bubble and the liquid. We construct the phase diagrams by comparing the predictions of simplified models with the full analytical solution. Heat and vapor mass diffusion inside the bubble significantly restricts the maximum evaporation flux that one obtains when assuming uniform vapor pressure inside the bubble. This mechanism influences the bubble oscillation for bubbles containing a significant amount of vapor (mass fraction larger than 0.5) in a range of frequencies that is influenced by the enthalpy of vaporization and the ratio of thermal conductivities. The proposed analysis is meant to be useful for the validation of full 3D numerical codes dealing with phase change processes.

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