Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Mass transfer effects in linear wave propagation through bubbly liquids[1] DANIEL FUSTER, Institut D'Alembert CNRS-UPMC — In this work we present a model to capture the influence of mass transfer effects on the effective acoustic properties of bubbly liquids. The solution of the conservation equations inside the bubble (e.g. continuity, momentum, energy and species) is coupled to the solution of the conservation equations in the liquid surrounding the bubble using local balances across the interface and a linearized version of the mass transfer flux obtained from the Hertz-Knudsen-Langmuir formula. The model is able to capture the transition from gas bubbles containing a non-soluble gas to gas/vapor bubbles with a given vapor/gas ratio. In addition to the influence of the enthalpy of vaporization, the velocity jump appearing at the interface is shown to have a significant influence in both, the effective phase velocity and the attenuation of the medium near the saturation line. The validity of common assumptions typically used in simplified models and limiting solutions obtained from the current approach are discussed in terms of characteristic non-dimensional numbers. Consistent with previously published data, the influence of mass transfer effect is specially notorious at low frequencies.

[1]The author would like to acknowledge the support of Total R&D, and specially to F. Montel and C. Boehm for their fruitful discussions.

Daniel Fuster
Institut D'Alembert CNRS-UPMC

Date submitted: 16 Jul 2014 Electronic form version 1.4