Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Experimental and Numerical Investigation of Pressure Wave Attenuation due to Bubbly Layers[1] ARVIND JAYAPRAKASH, TIFFANY FOURMEAU, CHAO-TSUNG HSIAO, GEORGES CHAHINE, Dynaflow Inc., DYNAFLOW INC. TEAM — In this work, the effects of dispersed microbubbles on a steep pressure wave and its attenuation are investigated both numerically and experimentally. Numerical simulations were carried out using a compressible Euler equation solver, where the liquid-gas mixture was modeled using direct numerical simulations involving discrete deforming bubbles. To reduce computational costs a 1D configuration is used and the bubbles are assumed distributed in layers and the initial pressure profile is selected similar to that of a one-dimensional shock tube problem. Experimentally, the pressure pulse was generated using a submerged spark electric discharge, which generates a large vapor bubble, while the microbubbles in the bubbly layer are generated using electrolysis. High speed movies were recorded in tandem with high fidelity pressure measurements. The dependence of pressure wave attenuation on the bubble radii, the void fraction, and the bubbly layer thickness were parametrically studied. It has been found that the pressure wave attenuation can be seen as due to waves reflecting and dispersing in the inter-bubble regions, with the energy absorbed by bubble volume oscillations and re-radiation. Layer thickness and small bubble sizes were also seen as having a strong effect on the attenuation with enhanced attenuation as the bubble size is reduced for the same void fraction.

[1]This study was supported by the Department of Energy, under SBIR Phase II Contract DE-FG02-07ER84839.

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Date submitted: 09 Nov 2012 Electronic form version 1.4