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Compression of multiwall microbubbles NATALIA LEBEDEVA, SAM MOORE, University of North Carolina at Chapel Hill, ANDREY DOBRYNIN, University of Connecticut, MICHAEL RUBINSTEIN, SERGEI SHEIKO, University of North Carolina at Chapel Hill — Optical monitoring of structural transformations and transport processes is prohibited if the objects to be studied are bulky and/or non-transparent. This paper is focused on the development of a microbbuble platform for acoustic imaging of heterogeneous media under harsh environmental conditions including high pressure (<500 atm), temperature (<100 ˚ C), and salinity (<10 wt%). We have studied the compression behavior of gas-filled microbubbles composed of multiple layers of surfactants and stabilizers. Upon hydrostatic compression, these bubbles undergo significant (up to 100×) changes in volume, which are completely reversible. Under repeated compression/expansion cycles, the pressure-volume P(V) characteristic of these microbubbles deviate from ideal-gas-law predictions. A theoretical model was developed to explain the observed deviations through contributions of shell elasticity and gas effusion. In addition, some of the microbubbles undergo peculiar buckling/smoothing transitions exhibiting intermittent formation of facetted structures, which suggest a solid-like nature of the pressurized shell. Preliminary studies illustrate that these pressure-resistant microbubbles maintain their mechanical stability and acoustic response at pressures greater than 1000 psi.

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