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Longitudinal Ultrasonic Velocity and Attenuation Approach to Probe Properties of Multiphase Biological Materials with Voids Impeded

Hussein M Elmehdi
Applied Physics and Astronomy Department
University of Sharjah, United Arab Emirates

The size and concentration of voids in biomedical materials plays an important role in the structural integrity of these materials. The later has an impact on performance and quality of such materials. To monitor and assess the size and distribution of voids that are dispersed within the multiphase material, one needs a noninvasive technique that preserves the structure of the material. Ultrasound has proven to be an excellent candidate to provide quantitative assessments of the voids size concertation allowing theoretical models to be used to assess the elastic properties of such materials as the size and concertation of voids is varied.

In this paper, we present the results of an ultrasonic investigation carried out to measure bubble size and distribution in multiphase soft biological materials with bubbles impeded. After a brief discussion of the ultrasonic technique, the results of longitudinal velocity and attenuation measurements will be presented, which will be sued in elasticity models to characterize the elastic properties of the materials. To further investigate this, materials with wide range of void fractions were examined. The results clearly show the sensitivity of longitudinal ultrasonic and attenuation coefficient to void factions within the sample, highlighting the potential of ultrasound as a noninvasive tool for probing the properties of materials with voids impeded.

Keywords: Ultrasonic, void fraction, longitudinal velocity, attenuation coefficient, elastic properties