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Liquid Temperature Effect on Sound Propagation in Polymeric Solution with Gas Bubbles

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Abstract : Acoustic properties of polymeric liquids are high sensitive to free gas traces in the form of fine bubbles. Their presence is typical for such liquids because of chemical reactions, small wettability of solid boundaries, trapping of air in technological operations, etc. Liquid temperature influences essentially its rheological properties, which may have an impact on the bubble pulsations and sound propagation in the system. The target of the paper is modeling of the liquid temperature effect on single bubble dynamics and sound dispersion and attenuation in polymeric solution with spherical gas bubbles. The basic sources of attenuation (heat exchange between gas in microbubbles and surrounding liquid, rheological and acoustic losses) are taken into account. It is supposed that in the studied temperature range the interface mass transfer has a minor effect on bubble dynamics. The results of the study indicate that temperature raise yields enhancement of bubble pulsations and increase in sound attenuation in the near-resonance range and may have a strong impact on sound dispersion in the liquid-bubble mixture at frequencies close to the resonance frequency of bubbles.

Keywords : sound propagation, gas bubbles, temperature effect, polymeric liquid
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