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The rising velocity of a slowly pulsating bubble in a shear-thinning fluid MARCO DE CORATO, Institute for Bioengineering of Catalonia (IBEC), The Barcelona Institute of Science and Technology (BIST), YANNIS DIMAKOPOULOS, JOHN TSAMOPOULOS, Fluid Mechanics and Rheology Laboratory, Department of Chemical Engineering, University of Patras — We study the rising motion of small bubbles that undergo contraction, expansion or oscillation in a shear-thinning fluid. We model the non-Newtonian response of the fluid using the Carreau-Yasuda constitutive equation, under the assumptions that the inertia of the fluid and of the bubble are negligible, and that the bubble remains spherical. These assumptions imply that the rising velocity of the bubble is instantaneously proportional to the buoyancy force, with the proportionality constant given by the inverse of the friction coefficient. We evaluate the friction coefficient as a function of the rheological parameters and of the instantaneous expansion/contration rate of the bubble. Our results show that the radial motion of the bubble reduces the viscosity of the surrounding fluid, and markedly decreases the friction coefficient of the bubble. We find that the average rise velocity of a bubble undergoind radial pulsations is increased. We compare our predictions with the experiments performed by [S. Iwata, Y. Yamada, T. Takashima, and H. Mori. J. nonNewton. Fluid Mech., 151(1-3):30–37, 2008], who found that the rise velocity of bubbles that undergo radial pulsations is increased by orders of magnitude compared to the case of bubbles that do not pulsate.

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