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The dynamics of rising bubble inside a viscoplastic material
MANOJ TRIPATHI, KIRTI SAHU, Indian Institute of Technology Hyderabad, India, GEORGE KARAPETSAS, University of Thessaly, Volos 38334, Greece, OMAR MATAR, Imperial College London — The axisymmetric dynamics of a bubble rising in a Bingham fluid under the action of buoyancy is investigated. The equations of mass and momentum conservation, coupled to an equation for the volume fraction of the Bingham fluid, are solved used a Volume-of-Fluid (VOF) approach. A regularised constitutive model is used for the description of the viscoplastic behaviour of the material. We found that for large yield stresses, and for weak surface tension the bubble is highly deformable, and the rise is unsteady and is punctuated by periods of rapid acceleration, which separate stages of quasi-steady motion. During the acceleration periods, the bubble aspect ratio exhibits oscillations about unity, whose amplitude and wavelength increase with increasing yield stress and decreasing surface tension. These oscillations are accompanied by the alternating formation and destruction of unyielded zones at the bubble equator, as the bubble appears to "swim" upwards.

Kirti Sahu
Indian Institute of Technology Hyderabad, India

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