

Abstract Submitted
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Numerical simulation of a bubble rising in an unconfined viscoplastic fluid with chemical reaction MANOJ TRIPATHI, KIRTI SAHU, Indian Institute of Technology, Hyderabad, GEORGE KARAPETSAS, University of Thessaly, OMAR MATAR, Imperial College London — We investigate the flow dynamics of a rising bubble under the action of gravity surrounded by an unconfined Herschel-Bulkley fluid; a second-order chemical reaction is also taken into account. We solve the continuity, Navier-Stokes and energy equations coupled with Cahn-Hilliard equations associated with the mole fraction of the reactants and product. Interfacial forces are accounted for in the Navier-Stokes equations, and a Papathanasiou model is used to incorporate yield stress effects into the governing equations. The effects of various dimensionless groups, such as the Reynolds, Bond, Bingham, and Damkohler numbers, on the flow are investigated in terms of flow structure, concentration, velocity and temperature fields, bubble deformation, and unyielded regions. Our results for the unreactive case have been validated against previous work. The work on the reactive case is under progress and a parametric study of this investigation will be discussed at the meeting.

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