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Numerical and experimental investigations of an air bubble rising in a Carreau-Yasuda shear-thinning liquid BADARINATH KARRI, PREMLATA A. R., Indian Institute of Technology Hyderabad, India, MANOJ TRIPATHI, Indian Institute of Science Education and Research Bhopal, KIRTI SAHU, Indian Institute of Technology Hyderabad, India, KIRTI SAHU TEAM — The dynamics of an air bubble rising in a quiescent shear-thinning fluid modelled using a simplified Carreau-Yasuda rheological model is investigated numerically and experimentally. For the parameter values considered in the present study, a rising bubble in a shear-thinning fluid exhibits three-dimensional behaviour. Both path instabilities (zigzagging/spiralling motion) and topological changes are observed for an air bubble rising in a shear-thinning fluid. However, for a Newtonian surrounding fluid, a bubble maintains azimuthal symmetry and rises in a straight path for the same set of parameters. The mechanism of this three-dimensional behaviour is investigated by inspecting the variation of vertical vorticity component and viscosity. Experiments have also been conducted using a high speed camera to visualise the bubble rise behaviour in both Newtonian and shear-thinning fluids as surrounding media. The shapes and trajectories of the bubble obtained from experiments show qualitative agreement with those obtained from numerical simulations.

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