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Buoyancy driven interpenetration of immiscible fluids of different densities in a tilted tube J.P. HULIN, J. ZNAIEN, L. MENDONCA, A. SOURBIER, F. MOISY, D. SALIN, FAST Laboratory, Bat 502, Campus Paris Sud, 91405 Orsay (France), E.J. HINCH, DAMTP-CMS, CB3-OWA, Cambridge (UK) — The buoyancy driven interpenetration of two immiscible fluids of different densities and equal viscosities (salt water solutions and silicon oil) initially separated by a gate valve has been studied in a long tilted tube of small diameter (20mm). For increasing tilt angles θ from vertical, one observes first a turbulent flow where each phase becomes fractionated into many bubbles. Then, each fluid penetrates into the other, taking the shape of a large bubble of length increasing with time. The rear end of the bubble may either remain "attached" to the gate valve or move at a velocity lower than the front end. At tilt angles close to horizontal, each bubble of displacing fluid often becomes divided into a sequence of large bubbles or, alternatively, is replaced by a thin layer of fast moving fluid. The velocities of front and rear ends have been studied as a function of the experimental parameters and compared to usual characteristic velocities for large bubbles rising into another fluid. The influence of the density contrast between the fluids and of the initial conditions (tube cleaned before the experiment or prewetted by a previous displacement) are discussed.

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