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Concentration distribution in gravity driven mixing of two fluids in a tilted tube T. SÉON, J-P. HULIN, D. SALIN, FAST Laboratory, UMR 7608, 91405 Orsay Cedex (France)., B. PERRIN, LPA-ENS, UMR 8551, 75231 Paris 5 (France)., E.J. HINCH, DAMTP-CMS,CB3-OWA, Cambridge (UK). — The concentration distribution in the mixing zone of interpenetrating light and heavy fluids in a tilted tube is studied by laser induced fluorescence as a function of the tilt angle θ from vertical. At low θ, the flow is turbulent, resulting in efficient mixing across the tube. With increasing θ, a concentration difference appears across the tube section due to the transverse component of gravity. At large θ, this segregation is efficient enough for the concentration contrast at the fronts to become equal to the global density difference between the two original fluids. At still larger tilt angles, there is no mixing between fluids but a stable parallel counterflow controlled by viscous dissipation in the bulk of the fluids. In the two first regimes, the local concentration contrast $\delta\rho$ at the interpenetration fronts is shown to be directly related to the front velocity through $V_f \propto \delta\rho/\rho$. This confirms that these regimes correspond to a local balance between inertia and gravity at the front.

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