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Viscous Lock-Exchange in Rectangular Cells: Calculation and Experiments DOMINIQUE SALIN, University Pierre and Marie Curie, JEROME MARTIN, CNRS, NICOLE RAKOTOMALALA, University Pierre and Marie Curie, LAURENT TALON, CNRS — In a viscous lock-exchange gravity current, which describes the reciprocal exchange of two fluids of different densities in a horizontal channel, the front between two Newtonian fluids spreads as the square root of time. The resulting diffusion coefficient reflects the competition between the buoyancy driving effect and the viscous damping, and depends on the geometry of the channel. This lock-exchange diffusion coefficient has already been computed for a porous medium, a $2D$ Stokes flow between two parallel horizontal boundaries separated by a vertical height, H, and, recently, for a cylindrical tube. In this presentation, we calculate it, analytically, for a rectangular channel (horizontal thickness b, vertical height H) of any aspect ratio (H/b) and compare our results with experiments in horizontal rectangular channels for a wide range of aspect ratios ($1/10 - 10$). We also discuss the $2D$ Stokes-Darcy model for flows in Hele-Shaw cells and show that it leads to a rather good approximation, when an appropriate Brinkman correction is used. An extension to the case where the density contrast between the two fluids is generated by a chemical reaction is also discussed.

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