Abstract Submitted
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Rate of chaotic mixing in localized flows[1] PIERRE JOP, JALILA BOUJLEL, EMMANUELLE GOUILLART, FRANCK PIGEONNEAU, Surface du Verre et Interfaces, CNRS, Saint-Gobain, SURFACE DU VERRE ET INTERFACES TEAM — Most of the pastes in building materials are yield-stress fluids. Mixing them efficiently is required for industrial processes but linking the rate of the mixing to the fluid properties is a challenge. We study experimentally the rate of chaotic mixing in viscoplastic fluids by using a rod-stirring protocol with a rotating vessel. Only a limited zone localized around the stirring rods is highly sheared at a given time. Using a dyed spot as the initial condition, we measure the decay of concentration fluctuations of dye as mixing proceeds. Due to numerical simulations and experimental measurements, we relate the volume of highly sheared fluid to the parameters of the flow. We propose a quantitative two-zone model for the mixing rate, taking into account the geometry of the highly sheared zone as well as the rate at which fluid is renewed inside this zone. The model predicts correctly the scaling of the exponential mixing rates during a first rapid stage and a second slower one. Moreover we show that an optimal mixing exists when varying the ratio of the rotation rate of the vessel and the velocity of the rods.

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