Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Reversibility and instability of concentrated suspensions in oscillatory channel flow ALEJANDRO GARCIA, YANINA L. ROHT, Univ. de Buenos Aires, Fac. de Ingenieria, Grupo de Medios Porosos, GEORGES GAUTHIER, DOMINIQUE SALIN, Lab. FAST, Universite Paris-Saclay et CNRS, GERMAN DRAZER, Rutgers, The State University of New Jersey, JEAN-PIERRE HULIN, Lab. FAST, Universite Paris-Saclay et CNRS, IRENE IPPOLITO, Univ. de Buenos Aires, Fac. de Ingenieria, Grupo de Medios Porosos — The motion of individual particles has been tracked experimentally in a non-Brownian suspension of non-buoyant spheres (volume fraction between 0.2 and 0.4) subject to a square-wave oscillatory flow in a Hele-Shaw cell at low Reynolds numbers. We investigated the evolution of the suspension structure and velocity profile, as well as the microscopic reversibility of the particle trajectories, as a function of the amplitude A and period T of the oscillating flow. At short times, the flow is parallel with a blunted parallel velocity and a corresponding increase of particle concentration at the center of the channel, consistent with previous results and shear-induced migration models. The reversibility of the motion of the particles from one period to the next is strong in the center region but much weaker close to the walls. At longer times, an instability induces an exponential growth in the motion of the particles transverse to the flow, forming a periodic structure or recirculating zones along the channel. The wavelength and transverse velocity have been studied as a function of A and T. The reversibility of the particle motion is strongly reduced in this regime. We also discuss the presence of a threshold value in the cumulative strain for the appearance of the instability.

Alejandro Garca
Univ. de Buenos Aires, Fac. de Ingenieria, Grupo de Medios Porosos

Date submitted: 10 Aug 2020 Electronic form version 1.4