



HAL
open science

Particle self-diffusion in a viscous shear flow: from hydrodynamic interactions to collisional effects

Micheline Abbas, Eric Climent, Olivier Simonin, Martin R. Maxey

► To cite this version:

Micheline Abbas, Eric Climent, Olivier Simonin, Martin R. Maxey. Particle self-diffusion in a viscous shear flow: from hydrodynamic interactions to collisional effects. 61st Annual Meeting of the APS Division of Fluid Dynamics, Nov 2008, San Antonio, United States. pp.0. hal-04030197

HAL Id: hal-04030197

<https://hal.science/hal-04030197v1>

Submitted on 15 Mar 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Open Archive Toulouse Archive Ouverte (OATAO)

OATAO is an open access repository that collects the work of Toulouse researchers and makes it freely available over the web where possible.

This is an author-deposited version published in: <http://oatao.univ-toulouse.fr/>
Eprints ID : 2736

To link to this article :

URL : <http://meetings.aps.org/link/BAPS.2008.DFD.BQ.5>

To cite this version :

Abbas, Micheline and Climent, Eric and Simonin, Olivier and Maxey, M.R.
(2008) *Particle self-diffusion in a viscous shear flow: from hydrodynamic interactions to collisional effects*. In: 61st Annual Meeting of the APS Division of Fluid Dynamics, 23-25 Nov 2008, San Antonio, USA.

Any correspondence concerning this service should be sent to the repository administrator: staff-oatao@inp-toulouse.fr

61st Annual Meeting of the APS Division of Fluid Dynamics

Sunday–Tuesday, November 23–25, 2008; San Antonio, Texas

Particle self-diffusion in a viscous shear flow: from hydrodynamic interactions to collisional effects.

M. Abbas, E. Climent, O. Simonin and M.R. Maxey.

Abstract

Particle shear-induced self-diffusion is investigated at low Reynolds and variable Stokes (St) numbers. We simulated the suspension hydrodynamics for $St \ll 1$ by using the Force Coupling Method. For suspensions with finite particle inertia (finite St), we proposed a new Eulerian prediction based on the kinetic theory for granular flows which have been validated by discrete particle simulations assuming Stokes drag and binary collisions (for low to moderate solid concentration). On the microscopic level, the particle velocity fluctuations have a Gaussian distribution shape for both high and vanishing St , whereas they show a highly peaked distribution for suspensions characterized by $St \sim O(1)$ and low solid volume fractions. On the macroscopic level, the self-diffusion tensor is strongly anisotropic and the diffusive behavior becomes more prominent when the particle inertia increases. The self-diffusion coefficients decrease with concentration at high St . The results will be analyzed in terms of analogies and differences between the two regimes investigated (hydrodynamic interactions or collisional effects).