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Using Hydrodynamic Forces to Tune the Particle Adhesion on Microchannel Walls[1] DONATIEN MOTTIN, Université de Rennes 1, IPR - ENS Rennes, SATIE, FLORENCE RAZAN, ENS Rennes, SATIE, FRÉDÉRIC KANOUFI, Université de Paris, ITODYS, MARIE-CAROLINE JULLIEN, Université de Rennes 1, IPR, CNRS — Hydrodynamic studies have made it possible to predict and quantify the rate of adhesion of molecules to a reactive surface located in a straight channel under flow [Squires et al, 2008]. However, many applications deal with the adhesion of much larger objects like particles. The behavior of these objects is not described by existing theories that focus on point objects. In our study, we seek to extend the molecular theories to the capture of solid particles. While few of our experimental results are well predicted by the pre-existing theory, most of them give much lower capture rates. However, numerous studies have shown that the liquid surrounding a particle exert an inertial lift force that pushes it away from the walls, which may be responsible for this adhesion rate drop. We show, through numerical simulations and modeling, that it is possible to quantitatively predict our experimental adhesion rate, without any fitting parameters, using a new dimensionless number, the lifto-diffusive number. This highlighted phenomenon is highly non-linear and abrupt: in a particular regime, doubling the flow rate leads to a decrease by a factor of 15000 in the rate of particle adhesion, thus allowing to trigger or to prevent the adhesion of particles by a pure hydrodynamic lever.

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Donatien Mottin
Univ de Rennes I

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